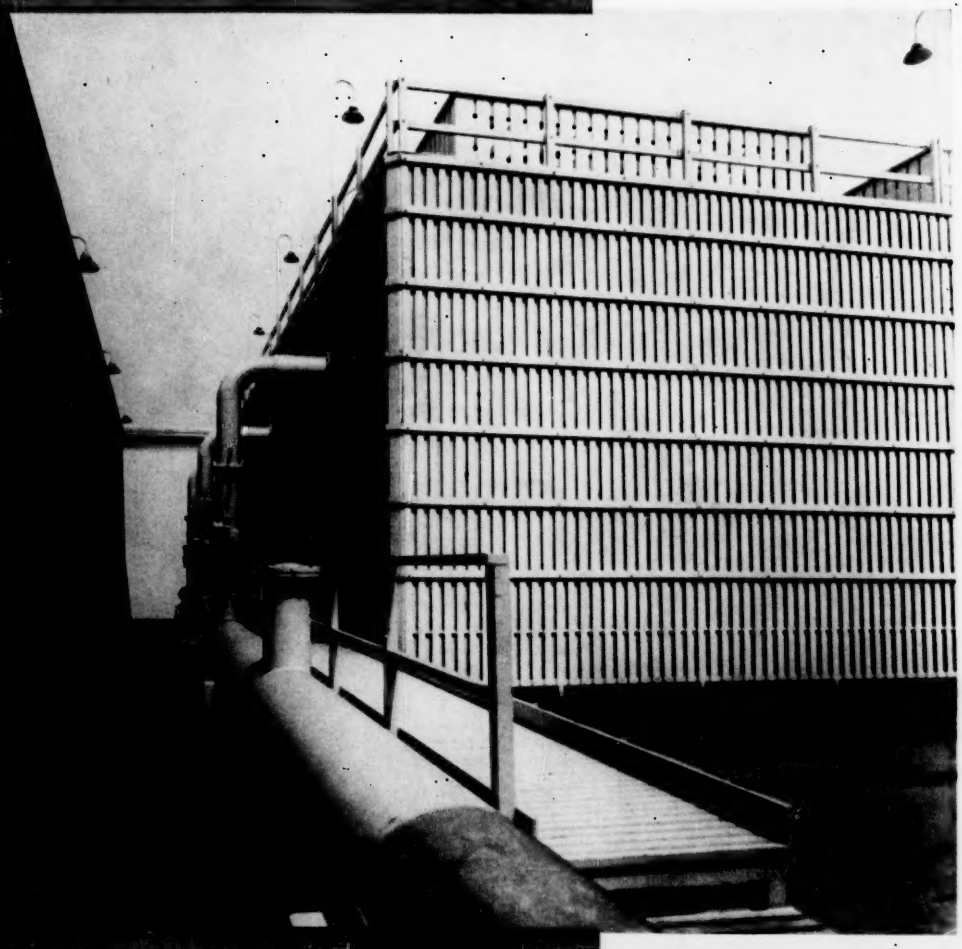
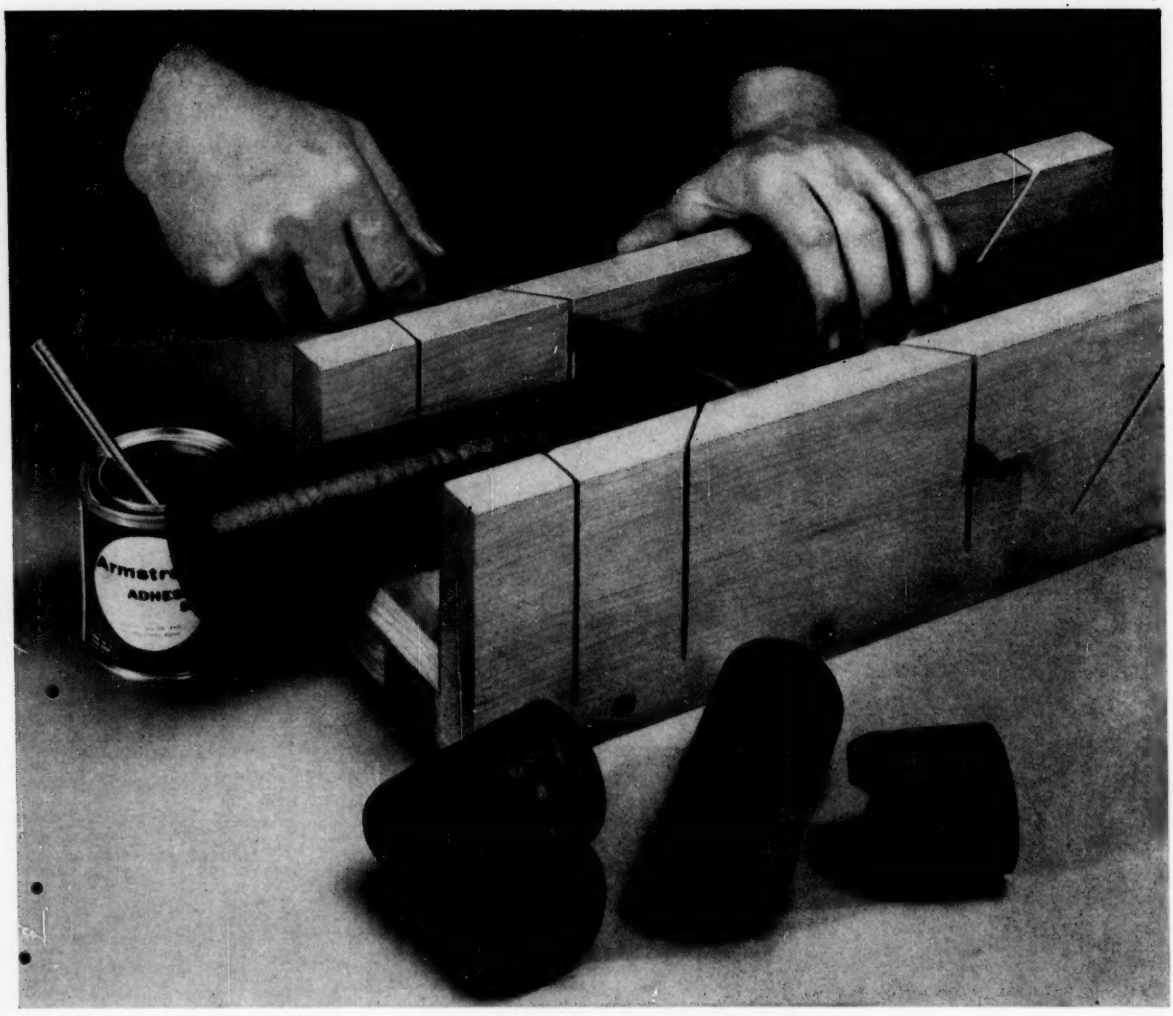
INDUSTRIAL REFRIGERATION

DECEMBER, 1958

Vol. 135 No. 6



ing And Refrigerating Plant



A miter box and a sharp knife are all that are needed to fabricate fitting covers fast with Armaflex.

Insulate fittings 50% faster with Armstrong Armaflex Pipe Covering

Armaflex is extremely flexible, readily follows contours of pipes or bent tubing without special cutting and fitting.

The time it takes to insulate pipe fittings properly can drop 50% or more when Armstrong Armaflex is used. Armaflex is the new, cellular, flexible foamed plastic insulation that is completely waterproof and vaporproof. There's no waste, and it doesn't chip, crumble, or rub off.

To make fitting covers, the material is cut quickly and accurately with a sharp knife. The pieces then are cemented together with Armstrong 520 Adhesive, slit lengthwise, and snapped in place. Since Armaflex is the same vaporproof material that insulates the pipe run, there's no need to buy wrap-on coverings, cements, twine, tape, or waterproof coatings. One insulation does all the work.

An Armaflex job is more than just fast. Fittings look neater, too. And the installation lasts indefinitely. Armaflex stays dry and efficient – will positively stop condensation when used in recommended thicknesses.

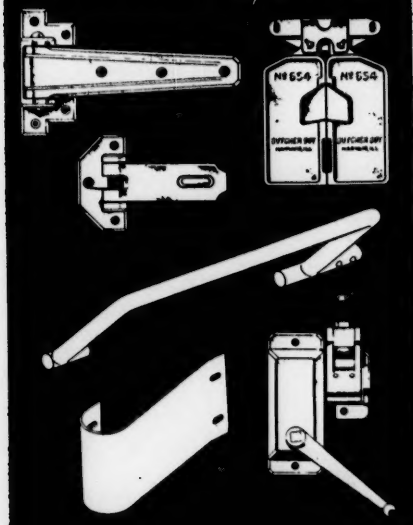
For full information on this remarkable pipe covering and complete instructions on how to apply it, write today to Armstrong Cork Company, 2212 Skye Drive, Lancaster, Pennsylvania.

Armstrong INSULATIONS

"Butcher Boy"
Since 1885

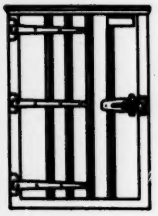
Refrigerator Doors

REFRIGERATOR DOOR
HARDWARE



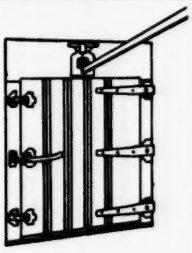
SAFETY RELEASE FASTENERS
No. 11 or No. 12
Permit opening from within even though padlocked from outside

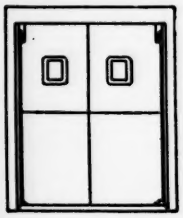
CATALOGS AVAILABLE UPON REQUEST



STANDARD COOLER-FREEZER DOORS

- Modern Streamlined Appearance
- 100% Douglas Fir Construction
- Massive and Durable Hardware



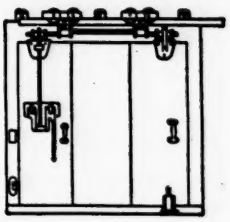


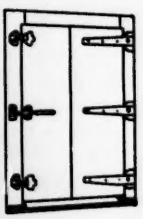
STANDARD VESTIBULE AND AUTO CLOSE DOORS

- Double Acting Doors for Loading Docks
- For Heavy Trucking Openings
- Save Refrigeration Losses

HORIZONTAL SLIDING DOORS

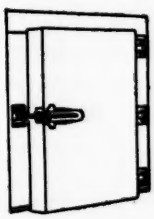
- Ideal where space factor is limited
- Recommended for Freezer Areas
- Available for manual, air, or electric operation
- Mechanically operated doors open and close in less than 4 seconds





LOW TEMPERATURE INFITTING AND SUPER FREEZER OVERLAP DOORS

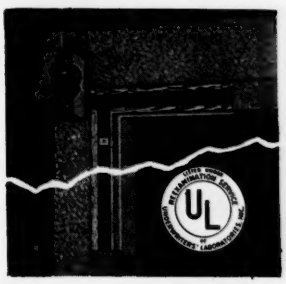
- Low Temperature Doors for +10 to —20° F
- Super Freezer Doors for —0 to —100° F
- Both types available with No. 51 electric defrosters
- Extra heavy duty hardware applications



New!

FULLY AUTOMATIC ELECTRIC DEFROSTERS

- Underwriter's Approved—An exclusive First with Butcher Boy
- Flexible "silicon" covered (not lead covered) heater cables
- Furnished with calibrated "thermostat"—economical heat control



BUTCHER BOY REFRIGERATOR DOOR CO. Dept. "MO" HARVARD, ILLINOIS

DRYNESS

best reason in the world for specifying

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SUPER-DRY REFRIGERANTS

In "Genetron" Super-Dry Refrigerants, moisture has been reduced almost to the vanishing point. "Genetron" 12, for example, has less than one-thousandth of one per cent of moisture! And the tight quality "specs" for "Genetrons" are usually *bettered* in production. "Genetron" Super-Dry Refrigerants are available from wholesalers everywhere. So be sure to make your next order—"*Genetron.*"

QUICK FACTS on GENETRON Super-Dry Refrigerants

- Guaranteed exceptionally low moisture content.
- Noncorrosive to standard equipment materials, nontoxic, nonflammable, stable, safe.
- Critical and freezing points well outside range of operating uses.
- Solvent action on oil helps prevent solidification or congealing of lubricant; aids in lubrication of equipment; generally miscible with oil.
- Freely interchangeable and may be mixed in any proportions with comparable fluorinated hydrocarbons meeting the same strict refrigerant specifications.
- Available everywhere, from refrigeration wholesalers throughout the country.

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Trichloromonofluoromethane

GENETRON 12 WHITE LABEL CCl_2F_2
Dichlorodifluoromethane

GENETRON 22 GREEN LABEL $CHClF_2$
Monochlorodifluoromethane

GENETRON 113 PURPLE LABEL $C_2Cl_3F_3$
Trichlorotrifluoroethane

GENETRON 114a BLUE LABEL $C_2Cl_2F_4$
Dichlorotetrafluoroethane

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

December, 1958

Number 6

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Industrial Refrigeration

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Retirement funds of Los Angeles County Employees have been invested by their Association in a Central Station Heating-Refrigerating Plant which is leased back to the County. This 4 million dollar plant and its associated utility tunnels is first of a number of multi-million dollar projects.

Ultra-Low Temperatures with Magnetic Refrigerator 13
Continued progress is reported in the development of a magnetic refrigerator for achieving ultra-low temperatures reliably. A new paramagnetic salt cell appears more stable than previous units.

Heat Gain Tests of Refrigerated Trailers 14
National Bureau of Standards reported in October on the current tests of three commercial refrigerated truck trailers. Air infiltration simulation was not only the big problem, but tests also indicate a savings to two-thirds in cooling load if infiltration can be eliminated.

NAPRE Adds Officers, Expands Education Service 16
Going into its 49th year as a national not-for-profit association of refrigeration engineers, this group is emphasizing the importance of accepting automation, and is working on up-grading and expansion of its practical educational program.

What is Power Factor 22
Understanding power factor seems to be a continuing perplexity for management and engineers alike in some areas of the U.S. A series of Questions and Answers on the subject is reprinted from REFRIGERATION SERVICE AND CONTRACTING.

Refrigeration—Service to Humanity 27
Thumbnail review of applications for the industrial field is given in this address by H. T. Dewhirst. Food preservation still dominates other uses in importance to the human race.

Condensation, Insulation Failures Preventable 30
Surface temperature of insulation and confined space ambient important in preventing condensation damage by air conditioning.

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The Cover: Cooling Tower For A Civic Center

▶▶▶ **COUNTERFLOW induced draft tower for the Los Angeles County Central Heating and Refrigerating Plant, stands 20 feet high and is concealed by a louvered architectural arrangement such as shown at the left. Provision is made in the foreground for several additional cells. Condenser water is delivered to the tower at 105 F and leaves at 85 F. Construction is redwood.**

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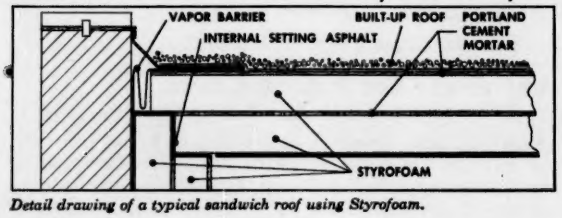
General Offices: 433 N. Waller Ave., Chicago 44, Ill. Teles.: AUstin 7-1303-04-05

Designer: Ward Ice Industries, Ft. Smith, Arkansas. *Approved Insulation Contractor: Chris Fiedler Company, Inc., Memphis, Tennessee.*

Unique sandwich roof construction using Styrofoam® saves $20,000

Rogers Ice and Cold Storage Company, Rogers, Arkansas, put the rigidity, light weight and high compressive strength of Styrofoam* to good use in their new 24,000 sq. ft. cold storage plant.

In this sandwich roof construction, two 4" thicknesses of Styrofoam—with a ¼" layer of portland cement mortar sandwiched between them—were laid directly on the roof joists.



Detail drawing of a typical sandwich roof using Styrofoam.

A ½" portland cement mortar grout was put down over this sandwich and a built-up roof applied in the normal manner. The concrete slab, which is standard for this type of roof, was eliminated because Styrofoam is capable of supporting not only its own weight, but also that of the built-up roof and the foot traffic necessary for inspection and maintenance!

Eliminating the concrete slab allowed a reduction in the amount of structural steel used and, of course, an over-all reduction in labor . . . adding up to a $20,000 savings! Styrofoam, used in the floors and walls, will provide superior insulating efficiency and reduced maintenance for Rogers, too. For more information about Styrofoam in cold storage uses, contact your nearest Styrofoam distributor or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1914L-1.

*Dow's registered trademark for its expanded polystyrene

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for pipe covering insulation

Low-temperature pipe covering made of Styrofoam* does an excellent job and lasts a lifetime. Its unyielding resistance to moisture and its permanent low thermal conductivity prevent condensation and dripping—reduce heat transfer.

Styrofoam will not crack or split from changing temperature and it is not subject to ice buildup around valves. It's lightweight and easy to apply—requires no maintenance. A complete line of pipe and vessel covering made from Styrofoam is available from a number of fabricators. For their names and more information, write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1905L.

*STYROFOAM is a registered trademark of The Dow Chemical Company

DOW

news briefs—

ASHAE And ASRE Become ASHRAE

Voting at Chicago and New Orleans respectively on Dec. 1, members of the American Society of Heating and Air Conditioning Engineers and the American Society of Refrigerating Engineers adopted resolutions approving a merger plan. New title of the combined group is American Society Heating, Refrigeration and Air Conditioning Engineers.

Budget Bureau Speaker Addresses Ice Cream Makers

Dr. Edward T. Crowder, Bureau of the Budget, addressed the International Association of Ice Cream Manufacturers at their Statistical Research Committee meeting in Washington, D. C. on November 13. Crowder discussed the government statistical activities, and how government and industry assist each other in this field. Other subjects for the committee's attention were a number of surveys which expanded statistical information by IAICM to large and small ice cream manufacturers, serving to keep them up to date with industry trends and developments.

U.S. Retains Second Place Among Fishing Nations

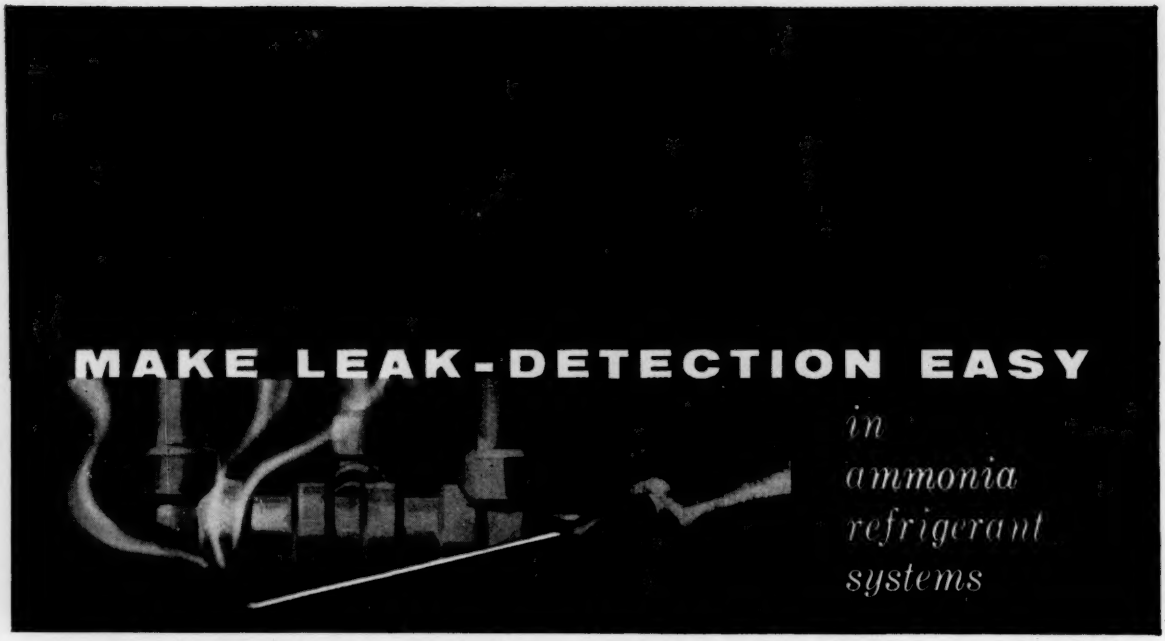
Latest edition of the Food and Agricultural Organization Yearbook of Fisheries Statistics reveals that the United States including Alaska retain second place among the world's fishing nations. However, the United States is falling farther behind Japan, which is in first position, while China (Main Land) and USSR are tending to close the gap between themselves and the United States. Last figures show that Japan caught 5-1/3 million tons of fish compared with 2-2/3 million tons of fish caught by the United States. Japan catches 18 percent of the world landings.

Enlarge Patent Suit On Ice Flaking Machine

A supplemental complaint filed by a division of King-Seeley Corp. and the owner of U. S. patent No. 2,753,694, prompted the U. S. District Court of Chicago to enlarge the infringement suit against a Chicago firm. The complaint brings the latest model of ice flaking machine manufactured by the Chicago firm also under charge of infringement.

NAII Re-elects Officers and Directors

41st Annual Convention, National Association of Ice Industries, held at the Bayfront Auditorium, Miami, Florida, November 17-21, reelected all officers and directors. President is Richard C. Muckerman, City Products Corp., Paul W. Easton, Union Ice Co. and P. A. Buehrman, American Ice Co., Vice-presidents, George Steers, Kalamazoo Ice and Fuel Co., Treasurer, Wm. T. Jobe, Executive Vice-president and General Counsel, and C. P. Austin, Secretary.



... Just contact your local distributor of Barrett® Brand Anhydrous Ammonia, listed below. He'll be happy to supply you with handy "Sulfstix" Ammonia Leak Detectors. And you can count on him for prompt, courteous service on Barrett Brand Ammonia – the purest, *driest* refrigeration grade ammonia you can buy!

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GEORGIA
Macon: The Anderson Chemical Co., Inc., 1620 Waterville Rd. P. O. Box 1424

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Chicago: Westland Engineering Supply Co. 53 W. Jackson Blvd.

INDIANA
South Bend: Mid-Continent Chemicals, Inc. 2217 So. Main St.

IOWA
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New York: Nitrogen Div. Allied Chemical & Dye Corp., 40 Rector St.
New York: N. H. Heyman, Inc., 168 E. 91st St.
New York: E. M. Sergeant Pulp & Chemical Co. 7 Dey St.
Poughkeepsie: Duso Chemical Co., Inc., Fulton & Fairview St. P. O. Box 665
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Big Spring: T & T Supply Company, Inc. 1380 East Third Street Big Spring Texas
Dallas: Chas. H. Platter & Co., Texas Bank Bldg., P. O. Box 5998
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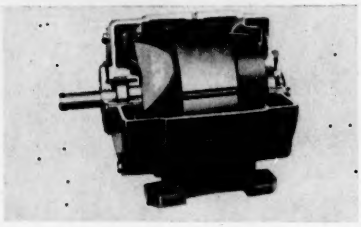
What's New

MACHINERY
APPLIANCES • PROCESSES



Electric Motors For Contaminated Areas

▶MOTORS with silicone-rubber insulation rated for Class B temperature rise available at the same price as conventional Class A machines with organic taped and varnish insulation have been announced by one Milwaukee manufacturer. Full protection of the motors makes possible substantial savings to users in the chemical, petroleum and other fields, wherever moisture, heat, dirt, dust, or other contaminants are a problem.

Open-type motors of this firm will rely on protective qualities inherent in the silicone rubber insulation to withstand atmospheric contaminants. Complicated motor enclosures, designed to protect inadequate insulations, have been eliminated.

Resistant to oils and chemicals found in many industrial applications, Silco-Flex insulated Super-Seal motors are claimed to need no extra protection against corrosives or oils. Field coils of synchronous motors by this manufacturer are as well protected as stator coils. Integrated construction, which combines epoxy resins and oriented glass fibers in a fully sealed indestructible field coil, locked to the pole piece, is now a standard feature, with no price increase.

Moisture-Free Hermetic Motors

▶HERMETIC MOTORS with an essentially moisture free all-synthetic insulation system have been announced by the Holland, Mich., facility of a national motor manufacturer, as available for air conditioning and refrigeration compressor applications. Capable of continuous operation at 35°F higher temperature level than possible with materials now in use, blistering or cut-through of the magnet wire is avoided with the use of enamel which common refrigerants will not soften.

The synthetic system consists of an acrylic resin magnet wire enamel, a ground insulation, and a polyester fiber for cable insulation,, sleeving, etc., having a high degree of chemical and thermal stability in refrigerants and oils commonly used in air conditioning and refrigeration applications. Hermetic motors insulated with these materials are available in fractional and integral hp ratings.

Immersible Motor

▶DESIGNED FOR submerged operation, another Milwaukee, Wis. motor manufacturer has marketed an immersible motor which is close-coupled to pumps, agitators and mixers, eliminating lengthy shaft connections, intermediate bearings, couplings and special bases. Suitable for operation in water, chemicals, abrasive industrial oils, etc., the motor is manufactured in ratings from ¾ to 40 hp polyphase and 3/4 to 5 hp single phase.

Flexible Coupling Has Rubber Toothed Sleeve

▶MECHANICAL power can be transmitted by a new Sure-Flex coupling which has only three basic parts: two hub flanges and a two-piece rubber sleeve. The internal and external teeth of the flexible sleeve mate with the flange hub teeth and lock tight under torque load without clamps or screws. The elastic rubber sleeve with two planes of engagement absorbs both angular and parallel misalignment. There are no rubbing or wearing surfaces; hence, no need for lubrication. All shock vibrations are absorbed and prevented from being transmitted by the coupling sleeve.

Final assembly of the coupling can be made without tools of any kind. Shaft alignment is checked from precision-machined coupling flanges. Halves of the split rubber sleeve slip axially into place. A retaining ring may be added to hold the split sleeve for high-speed operation. Declutching is as easy as assembly. Simply slide one hub flange along its shaft until the sleeve can be slipped out of the hub flanges. Shaft alignment does not need to be disturbed. There are no bolts to untighten, no covers, gaskets nor seals to remove, no greasy messes. The coupling is unaffected by abrasives, dust, dirt or moisture.

Motorized Gear Unit

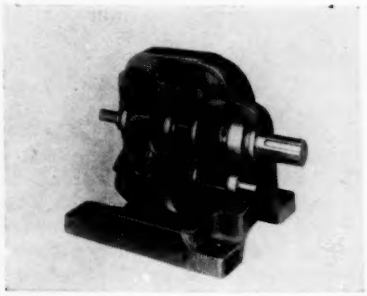
▶GEARMOTOR line of a Milwaukee motor manufacturer has been increased to include a motorized gear unit. Line-A-Spede drivers are gear reducers powered by standard NEMA frame motors mounted on a shelf triple and quadruple reduction gear units, with ratios up to 1487 to 1, are available for motor ratings of 1 to 75 hp.

The unit is designed for installations where down time is critical. Motors can be replaced rapidly by disconnecting the coupling between motor and reducer. In multi-unit generator installations of similar rating, stand-by protection is afforded by one stand-by motor of the largest size required.

Helical Gear Drives

▶QUADRUPLE reduction helical gear drive and larger sizes of double and triple reduction drives to augment its present line of double and triple reduction In-Line helical gear drives has been announced by a Chicago firm. Drives to more than 200 hp are available.

Extremely compact quadruple reduction speed reducer, available in five sizes, extends the range of ratios as high as 2.217:1. Simple gear arrangement of these speed reducers consists of helical gear trains operating in high capacity ball and roller bearings. Space requirements and layout problems are minimized by locating input and output shafts in the same horizontal plane.



COUNTY EMPLOYEES BUILD, LEASE LOS ANGELES REFRIGERATING PLANT

By FRED HERR
Los Angeles Correspondent
Industrial Refrigeration

▶▶▶RECENT INVESTIGATIONS by the Congress have shown some instances of misapplication and abuse of laboring groups' welfare funds. Los Angeles County employees on the other hand should be cited as one group who are apparently investing their funds well. Three new projects in the Los Angeles Civic Center are being built and financed by Los Angeles County Employees Retirement Association.

First of the three buildings in the Civic Center to be completed is the new Central Heating and Refrigeration Plant. The Association financed and constructed this building. The County will pay an annual rental fee under a lease with option to buy. The other two buildings are the $28 million dollar Hall of Administration and an $11 million dollar Hall of Records. The Employees Retirement fund is made up by the contributions of County workers and from the tax funds as fixed by law.

Expected to save over four million dollars in air conditioning and heating costs in a 20-year period, Los Angeles County's new $3½ million dollar central heating and refrigeration plant was officially dedicated in mid-August. The plant is situated at the northwest corner of Temple Street and Broadway, in the Civic Center where eventually all city, county, state and federal buildings serving the Los Angeles area will be located.

With its four Refrigerant 11 systems totalling 4400 Tons of Refrigeration, the new plant is described as the largest multiple feeder-type refrigeration distribution system west of the Mississippi River. It is designed to provide the complete heating and cooling needs for all county buildings now in use, as well as for several under construction and in the planning stage. The cooling and heating capacity has been calculated to handle the needs of new county buildings as they are completed.

Buildings now being served include the Hall of Justice which houses the sheriff's and coroner's facilities, municipal and superior courts, the district attorney's and county assessor's offices, plus the county jail on the three upper floors; and the Hall of Records. The present Hall of Records will be served from the central plant until it is razed in a year or so to be replaced by the new Records Building on the west side of the Civic Center. Other structures to be tied in to the central plant are the vast new County Courthouse of 800,000 square feet floor area, and a million square foot County Administration Hall, both of which are now under construction; and a County Garage on which work has not yet started.

Windowless Structure

Built of reinforced concrete and structural steel, the heating and cooling plant has the height of a four story building and contains 36,000 square feet of floor area, exclusive of the tunnels which connect it to Civic Center buildings. The structure is windowless, getting its ventilation through horizontal aluminum louvers.

In addition to producing operating savings of $2,972,000 in county heating costs and $1,603,000 in air conditioning expenses over a 20-year period, the central distributing system obviates individual heating and cooling installations within the buildings served, with consequent savings in space and equipment.

Heating, cooling and control equipment is grouped in installations in basement, first floor, mezzanine and upper floor machinery rooms. The building is topped by a cooling tower concealed by vertically louvered walls (see Cover illustration).

Turbine Driven Compressors

Steam provides heat and also powers the turbines that drive the plant's four refrigeration systems for air conditioning. The five gas/oil fired Springfield boilers, each of which produces 30,000 pounds of steam per hour at 275 pounds pressure, are basic to the plant's year round operation: steam for heating in winter and steam power to operate the four Worthington refrigeration systems for air conditioning in summer. This utilization of steam, it was pointed out, allows the boilers to operate efficiently at all seasons.

The plant's near automatic engineering necessitates a crew of only six operators per shift in three eight-hour shifts per day. John Fudge is chief engineer, and James Keeler assistant chief (see Fig. 1).

Underground Services

A network of approximately 1500 feet of reinforced concrete utility tunnels, costing an additional million dollars, 15 to 20 feet under ground, connects the plant with the Civic Center structures which it serves. The 10-foot-high subterraneans carry six distribution lines which are supported on roof-hung structural steel beams carrying expansion rollers (see Fig. 2).

The tunnels also serve as pedestrian walk-ways, provide bomb shelters if needed, and carry some electrical service and telephone lines. The network will ultimately be so complete that service men will be able to pass from the central plant to

Los Angeles County Central Heating-Refrigerating Plant, Civic Center

Fig. 1—John Fudge (right) chief engineer, checks unit refrigeration pressures with James Keeler, assistant chief. Gauge board is one of four mounted at Refrigerant 11 chiller units.

any county building in the Civic Center without going above ground.

The distribution line system in the tunnels consists of:

Two steel 20-inch diam. chilled water supply and return lines for the air conditioning system, in which water is distributed at 45 F and returned at 55 F;

Two steam lines of eight-inch diameter steel, carrying steam at 275 psig;

One four-inch diameter copper water line for distribution of softened domestic cold water;

One four-inch diameter steel line for returning condensate to the plant's deaerating feedwater heaters.

Tunnel Details

The tunnel pattern completed as of August 1958, is shown in Fig. 3. An L-shaped hallway runs east-west, then north-south in the sub-basement of the plant, with the various chilled water, steam and condensate lines feeding into it from the refrigeration and boiler machinery rooms on the upper floors.

At the south end of the sub-basement the hallway connects with the east-west branch of the roughly U-shaped tunnel system which underlies the Civic Center. From the juncture with the plant's sub-basement exit, the main tunnel extends eastward under Broadway to the basement of the Hall of Justice, a distance of approximately 75 feet. From the Hall of Justice another arm of the tunnel system runs southward approximately 500 feet into the basement of the Hall of Records.

Westwardly from the Central Plant, the tunnel runs just north of Temple Street to a point about 50 feet west of Hill Street. There it veers southward into the sub-basement of the new County Administration Building which is still under construction; and then continues 500 feet onward to the basement of the new County Court House, also under construction. A short tunnel has been completed from the Administration Building, under Hill Street, to a temporary dead-end at the building line of the site of a proposed new Hall of Records, which is to be built next year. The tunnels are constructed under county-owned property and not under streets, except at the three crossing points on North Broadway and North Hill Street.

Cooling Plant Equipment

Refrigeration is produced by four centrifugal refrigeration systems—two of 900 TR capacity each, and two of 1300 TR, each. These machines are set up in the eastern end of the lower level refrigeration room. The 900-ton installations are each capable of cooling 2160 gpm of water from 54 F to 44 F when supplied with 2700 gpm of 85 F condensing water. The two 1300-ton installations, each rated at cooling 3110 gpm of water from 54 F to 44 F when supplied with 3890 gpm of 85 F condensing water, are equipped with tandem centrifugal compressors (see Fig. 4).

Major equipment in the four conventional water chilling units consists of centrifugal compressors, refrigerant condensers, evaporators, and the steam turbine drives which derive their energy directly from the boilers. The four chilled water pumps serving each unit have a combined capacity of 10,540 gpm (see Fig. 5).

Fig. 2—Looking into one of the service tunnels from the central heating and cooling plant to the Los Angeles Civic Center buildings.

Consultant, General and Mechanical Contractors

M. A. Nishkian
Consulting Engineer
Long Beach

T. Fred Frandsen
Haas-Haynie-Frandsen
Beverly Hills

W. W. Price, Jr.
Scott Co. of So. Cal.
North Hollywood

Retirement funds for Los Angeles County employees financed construction of a central station utility and services tunnel, plus two new civic buildings. The County leases facilities with option to purchase.

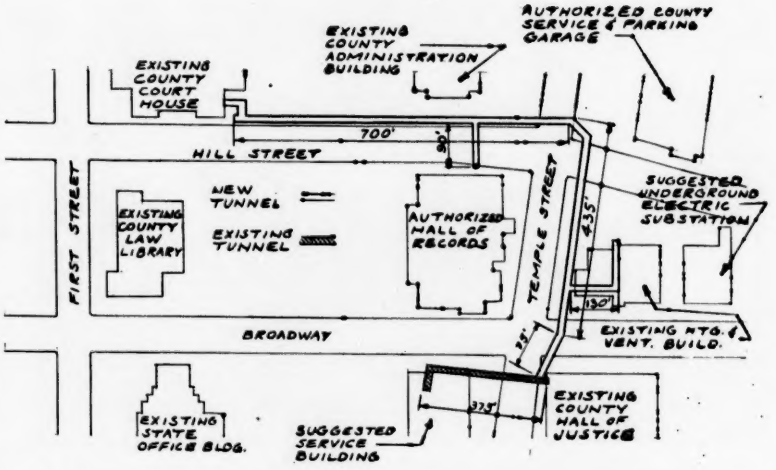


Fig. 3—(Above) Diagram of 1500 ft. tunnel system shows how the service subterranean is located mostly under county property.

Fig. 4—(Right) One of two 1300-TR tandem driven machines in the Los Angeles plant. Two more 900-TR units also serve this central installation.

Compressors are of the balanced three-stage volute-casing type. The third stage impeller is placed in back-to-back position with the second-stage impeller. This arrangement has the effect of reducing axial thrust. Shaft and impellers are statically and dynamically balanced individually to insure a maximum life through smooth, vibrationless operation. A butterfly type suction damper is installed in the compressor suction to provide capacity control.

A mechanically operated shaft seal, positive in action, is provided which automatically goes into service when a compressor is shut down. It is completely automatic and is provided with a device interlocked with starting controls. Operation of the seal actuating mechanism is by means of oil pressure from the compressor lubricating system. This seal is designed to prevent leakage of refrigerant along the shaft during shut-down periods. An oil seal prevents leakage of refrigerant or air infiltration during operation.

The compressors are lubricated with conventional pressure systems, including pumps, oil filter with bypass and relief valve, oil pressure control valves, oil cooler, oil pressure gauge, and indicating bearing temperature thermometers with interlocked lubrication failure safety controls.

Auxiliary Pump Serves As Oil Failure Protection Unit

The system includes in addition to the four gear-type service oil pumps driven from the compressor shaft an auxiliary oil pump driven by a hermetically sealed electric motor. The pumps are fully immersed in a large capacity oil reservoir provided with gas tight sight glass.

Controls are so arranged that the compressor cannot be started unless oil under proper pressure is supplied to the compressor bearings. The auxiliary motor drive oil pump is manually started, thereby providing oil under pressure to all compressor bearings and to the compressor shaft seal before the compressor driver can be started.

Also, controls are so interlocked that in the event any unit service oil pump fails, the auxiliary motor driven pump will automatically go into service to maintain proper oil pressure to all parts of the compressor. Operation of the auxiliary oil pump is indicated by means of a red light on the gauge and instrument board.

Float controlled traps are provided for returning oil from bearing pockets to the oil reservoir. There is also a pump to return oil from the atmospheric side bearings to the oil sump when suction pressure is above atmospheric.

Vessel Construction

The oil cooler is externally mounted, an arrangement which, it is reported, reduces danger of water leakage into the refrigerant system and minimizes condensation of the refrigerant in the oil. An electric heater element is installed in the oil pump to prevent condensation of refrigerant in the oil during shut-downs, when ambient temperatures are low.

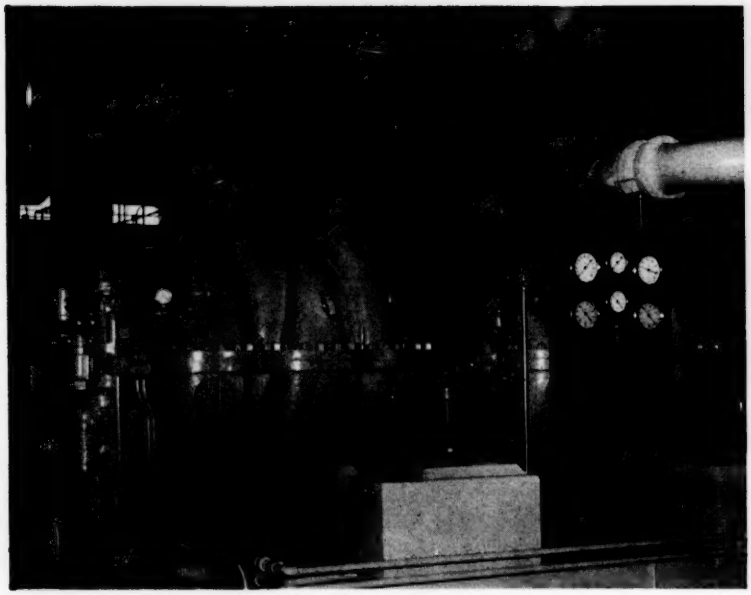
The four refrigerant condensers are horizontal multipass shell-and-tube types. The shells are of steel, the tube sheets of cupro-nickel, reinforced and electrically welded to the shell.

Each condenser has a water box of electrically welded steel at one end, so arranged that the head may be removed without disturbing water connections.Liquid refrigerant flow to the cooler is controlled by means of easily accessible high pressure type float valves. The 900-TR units have 1450 sq. ft. surface each and maximum dimensions are 37-in. diam.x17 ft; 1300-TRs have 2015 sq. ft. each, and are 43-in x 18-ft. Condenser tubes are integral finned.

The four evaporators are also horizontal multi-pass shell-and-tube type. Each evaporator is equipped with a nonferrous entrainment eliminator. These units are arranged with interstage liquid cooling for sub-cooling the liquid refrigerant from condensing temperature to intermediate temperature. Flash gas is conducted to intermediate compression stage through separate connection between the subcooler and centrifugal. Surface area is 1900 and 3115 sq. ft. each, repectively, for the 900/and 1300-TR units.

Central Purging

A unified purge and recovery system is provided to free the system of water, air and other non-condensables. This system consists of a fractional-hp electric motor-driven compressor, a system of piping for collection of non-condensable gases from the upper portion of the refrigerant condensers, a small purge condenser to liquify the water vapor and any refrigerant which has been removed



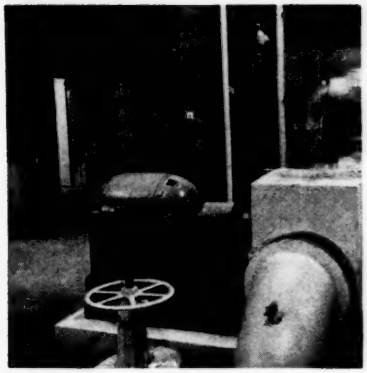
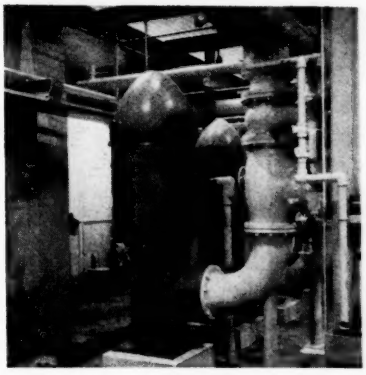


Fig. 5—(Above) One of four chilled water pumps having a total capacity of 10,500 gpm circulation.

Fig. 6—(Below) Part of a battery of four condenser water pumps located atop an underground sump.



from the system along with the noncondensable gases; and means for exhausting the noncondensable gases to the atmosphere, returning the liquid refrigerant to the main system, and draining off water. The purge compressor motor is started and stopped manually.

Compressors Turbine Driven

The plant has four steam turbine drives powered from boiler steam, not exhaust or auxiliary steam. The compressor driver for each of the 900-TR systems is a multistage steam turbine rated at 850 hp and 3100 rpm capable of variable speed. Turbines for the two 1300-TR systems are multistage steam turbines rated at 1280 hp and 4180 rpm, also with variable speed. Lubrication is forced feed. All four turbines are equipped with direct acting oil relay governor, emergency overspeed solenoid trip, safety control interlocks steam strainer, and automatic control valves.

Steam condensers are installed in the upper level refrigeration room, opposite the refrigerating unit condensers. They are of the surface barometric type, complete with atmospheric relief valve, and the tube side designed for 100 psig ASME.

Condensing Water System

Cooling tower for this central plant is located on the roof (see again, the Cover). It is a counterflow induced draft tower. It was designed, prefabricated and erected by Fluor Products Co., a division of the Fluor Corporation, Ltd. Approximately 87,800 board feet of California redwood was employed in the construction of the tower. Its dry weight is 159,000 pounds, and wet weight approximately 280,000 pounds. The tower's six cells are each equipped with 14-foot, 4-blade stainless steel fans, each driven by a 40-hp motor. Total height of the tower is 20 feet.

Condenser water is pumped from an underground reservoir which is located directly under the cooling tower circulating pumps (see Fig. 6). After circulating through the tower, the water falls back to the underground reservoir through two concrete shafts which are built into the structure immediately to the left and right of the pumps. In order to assure proper drainage from the cooling tower into the shafts, the roof of the building is pitched toward the shaft inlets.

The four cooling tower circulating pumps are vertical types, driven by electric motors. The four pumps have a total capacity of 13,180 gpm. The condenser water under normal conditions enters the cooling tower at 105 F where it is cooled to 85 F.

The plant's water treating facilities include four Zeolite water softeners to provide soft water for both the boiler feed and for piping to the county buildings. Salt storage for the softener operation is provided in the form of a 26-ton salt brine tank located at the northwest corner of the building into which salt can be unloaded directly from trucks. The brine, as needed, is pumped from the tank to the softeners.

Other storage tank facilities consist of a 50,000 and a 40,000 gallon fuel oil storage tank, and a 5000 gallon diesel oil storage tank. The three tanks are located along the western side of the building. The 5,000 gallon diesel oil tank is for use with an emergency generator located adjacent to the electrical switch gear room, and provides fuel for the emergency generator to run approximately one week in case of power failure.

A 5,000 gallon underground tank is located at the building's southwest corner for storing sulphuric acid used in connection with the chemical treatment facilities in the refrigeration machinery room. This tank is hydraulically operated to lower it out of sight when not in use.

The chemical treatment equipment includes the sulphuric acid tank, a phosphate and acid feed pump, and a sodium hyperchloride fuel .pump This equipment is employed to add corrosion preventive chemicals to the condenser water system. Emergency shower facilities and eye-wash installations are included in this section of the plant for use by operators in the event they come into contact with chemicals.

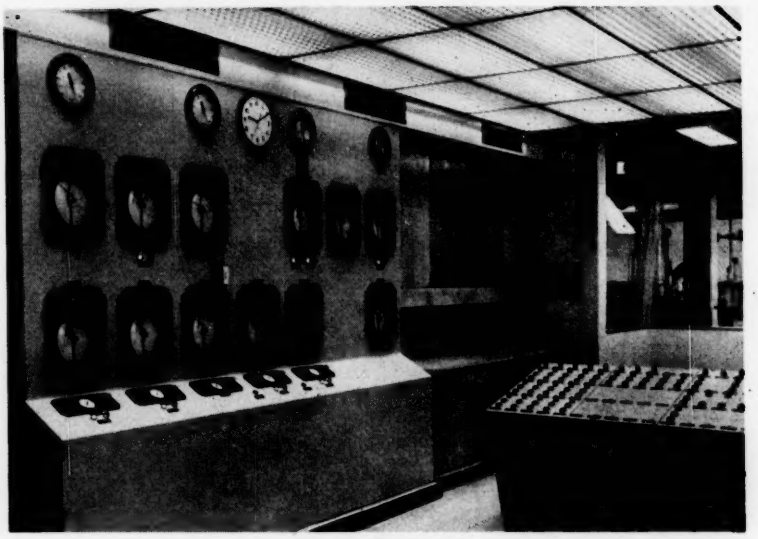


Fig. 7—(Right) Refrigeration control panel in the central control room, Los Angeles County Central Heating and Refrigeration Plant. The steam control panel is mounted on the opposite wall. The console at right provides remote control of all power and mechanical equipment throughout the plant. Instruments record flow, temperature and pressure in chilled water circulating loops, and steam flow to the centrifugal compressor turbine drives. A Btu instrument records TR delivered.

Forced and induced draft fans are employed in connection with the five 30,000-lb/hr boilers. Use of these fans made it possible to decrease the height of the stacks so that they are invisible from the street and do not mar the architecture of the building. The boilers were manufactured by Springfield Boiler Co. They are equipped with Peabody combination oil and gas burners.

Included in the plant's equipment are an instrument air compressor, a utility air compressor, two air filters and two air receivers. Most of the controls are operated pneumatically. Copper tubing is used for transmitting control and metering impulses between the equipment and the central control room. In the event of power failure a reserve source of compressed air may be cut in, or control drives and valves may be operated manually and, if desired, locked in position for base load.

Central Control Consoles

Both refrigeration and steam generation are controlled from a central control room. The control room measures approximately 15 feet in width and 25 feet in length. It is located in the central part of the first floor of the building, with full-width windows on its North and South sides overlooking the refrigeration and steam installations in basement and sub-basement levels. A refrigeration control panel is mounted on the East wall, a steam control panel on the West wall. A console on the floor between the two panels provides remote control of all power and mechanical equipment in the plant.

The instrumentation for the refrigeration system was provided by the Taylor Instrument Co. The console type panel incorporates conventional circular chart recorders for temperature, pressure, Btu and flow measurements (see Fig. 7).

Temperature of the master chilled water header is controlled by a recording controller. As the refrigeration load changes, the instrument increases or decreases the speed of turbines driving the refrigeration compressors. A group of automatic-to-manual switching stations on the console permits the operator to select one or more turbine-compressor combinations to be controlled simultaneously by the controller.

If the refrigeration load decreases sufficiently, an alarm in the chilled water temperature recorder signals the operator to shut-down a turbine (compressor) as desired. The balance of the system will continue to operate without attention.

Btu Recording

A unique feature designed to assist the operator and to provide a record of refrigeration load is the use of a Btu recorder on the control console. The temperature difference between the chilled water out flow header and return lines are simultaneously measured. These measurements operate a multiplying linkage in the Btu recorder which calculates and records the Btu value continuously.

All signals to the recording instruments are 3-15 psi pneumatic transmission. Temperature measurements are provided by potentiometer transmitters with resistance thermometer elements. Flow measurements are converted from square root to linear functions by Transverter pneumatic flow transmitters. Steam consumption by the turbines is recorded and integrated so that a 24-hour or weekly total consumption can be readily determined.

Boiler Operation

Operation of the five boilers is controlled automatically by combustion control equipment furnished by the Copes-Vulcan Division of Blaw-Knox Company. A master steam pressure controller senses changes in steam load and automatically initiates changes in boiler firing rate to meet the required steam demand. Automatic boiler water level control is accomplished with a three-element controller which balances feedwater flow against steam flow with secondary corrective action initiated by drum level.

Automatic controls are provided on air flow and fuel flow to the individual boilers. Fuel flow and air flow to each blower can also be remotely controlled manually from the steam panel board in the central control room. The system is designed so that the boilers can be fired with either oil or gas fuel. Smoke density recorders are provided for continuous monitoring of flue gas existing from the boilers, in order to warn the operator of excess smoke conditions so that the plant may comply with the requirements of the Los Angeles County Air Pollution Control District.

The plant was designed and engineered by M. A. Nishkian & Co., consulting engineers of Long Beach, Calif. Construction was by Haas-Haynie, Frandien, Inc., general contractors, Beverly Hills, Calif. The mechanical sub-contractor was the Scott Company, North Hollywood, Calif.

Achieving Ultra-Low Temperature Reliably

Development of the ADL Magnetic Refrigerator

CALEB WARNER
Research Engineer, Arthur D. Little, Inc.[1]

▶▶▶ RECENT development work on the ADL Magnetic Refrigerator has produced useful new practices in ultra-low temperature refrigeration. Ivan Simon, more recently in association with James Nicol, has been largely responsible for improvements in the device since originally perfected at Ohio State University in 1954.

The refrigerator follows the scheme reported by Heer, Barnes and Daunt, in 1954 whereby a paramagnetic salt is alternately magnetized and demagnetized, just as the gas in a conventional refrigerator is alternately compressed and expanded. Pure lead strips centered in solenoids can be switched magnetically from thermally conducting to non-conducting. Temperature fluctuations at the refrigerated experimental space are finally reduced by a thermal buffer or reservoir cell filled with a high-heat capacity paramagnetic salt. An experiment can thus be maintained at 0.25° K continuously.

Early Difficulties

Early users found, however, that it was difficult to attain expected low temperatures, and have been cooperating with ADL to pool ideas on various changes, it was realized late in 1957 that certain unexplained cryogenic difficulties remained in the device as then designed, so an intensive investigation was immediately begun. In developing what shows promise of being a reliable working salt cell, scientists have compromised carefully to meet a set of apparently contradictory requirements. Iron alum as a working salt gives us the most refrigeration, but it is readily and irreversibly dehydrated to a non-refrigerating form if raised above 30° C or evacuated at ambient.

Corrosion Vs Conductor

The salt therefore has to be encased in a vacuum-tight capsule and not warmed above 30°C during the cell's fabrication. The encasing material must resist the action of the highly corrosive alum, which would, in a matter of a few months, attack the normal low-temperature construction materials such as nickel-silver and stainless steel. The most obvious corrosion protection—silver plating—cannot be used on the container walls because silver produces a ready path for eddy currents during magnetic field changes, and hence heating can result, off-setting the refrigeration.

The new cell is packed with carefully selected alum. Large alum crystals are ground with an ice-cooled mortar and pestle. The alum is tamped hard into the cell container to assure maximum density of salt and hence maximum refrigeration for a given volume. Enough toluene or silicone oil is added to provide thermal contact between the powdered salt and the thermal conducting core. This core consists of a series of copper fins, silver-plated for corrosion protection, yet designed to minimize eddy current heating. The cell case is a thin tube of nickel-silver. The inside of the tube is protected against corrosion by a carefully prepared coating of thermo-setting plastic, a material used in wire insulation. The end pieces of the cell are nickel-silver, similarly plastic coated, and designed so that the final solder joint that seals the assembly can be made while the body of the cell is submerged in ice water to prevent dehydration of the salt. Results so far with these cells look promising.

Thermometer Characteristics

These cells require excellent thermal contact between metallic heat-collecting fins and the salt, long-term chemical stability, and of course adequate thermal capacity to smooth out the temperature variations caused by the normal cyclic operation. The salt of the cell is often used as a thermometer, and hence must be so positioned that a coil can be placed around it to measure changes in magnetic susceptibility as a temperature indicator.

After considering ferric acetyl acetonate, potassium chrome alum was decided on as the salt, since it is non-corrosive, the water of hydration is quite stable, and it has adequate specific heat to act as a buffer without inordinately retarding initial cooldown. Past practice has been to encase the chrome alum in a plastic tube without further sealing or increase in thermal contact.

Air-Conditioned NYC Nears 50 Percent Mark

▶▶▶ WHEN 20 BUILDINGS under construction in Manhattan, New York are finished, 51 percent of the major office space in that burrough will be air conditioned. This information was contained in a report earlier in the year by Hudik-Ross Co., mechanical contractors who had surveyed 93 million square feet of major office space in over 400 existing buildings and structures under erection. Major office space, according to the New York Real Estate Board, represents over 80 percent of the total assessed valuation of all office buildings in Manhattan. The survey indicated nearly 38 million square feet of air conditioned facilities were completed or underway after World War II and about 10 million square feet is installed in pre-war structures.

Refrigeration By Plumbers

▶▶▶ PLUMBERS have gained 3000 new members in the refrigeration industry in 1958, LABOR NEWS reported in November. Assistant General President, John J. McCartin, AFL-CIO affiliate was quoted. He addressed the Refrigeration and Air Conditioning Contractors Association annual convention at Colorado Springs, Colorado.

Cryogenics At Chicago

▶▶▶ CHICAGO SECTION ASRE, featured Dr. Hugh M. Long, Research Physicist, Linde Company, Tonawanda Laboratories, New York on the topic of Cryogenics, at their November meeting. Dr. Long remarked that the Greek word Cryogenics has in the last quarter century been used to denote engineering and scientific research concerned with temperatures below those attainable with ordinary mechanical refrigeration.

Until recently, the speaker pointed out, industrial cryogenics has been associated solely with oxygen production through the liquefaction and distillation of air. Now cryogenics is required in the petrochemical, missile, steel, and many other industries as well as in the distribution and production of oxygen, nitrogen, argon.

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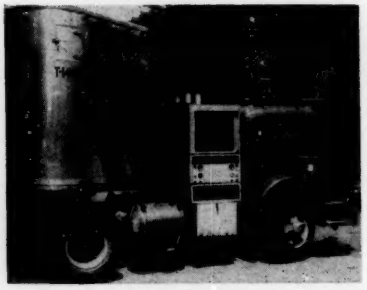
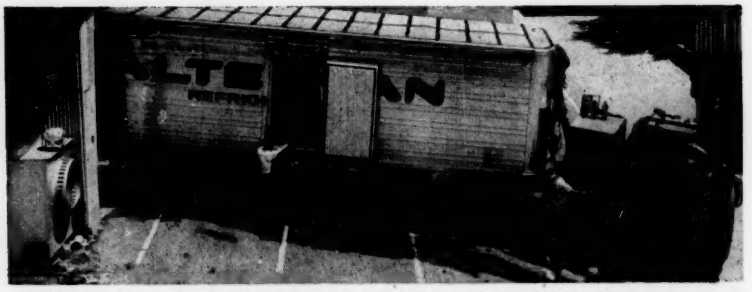
[1]This article reprinted with permission from Kelvin Scale Research and Engineering, a publication of Arthur D. Little, Inc., Cambridge, Mass. Kelvin Scale was formerly called Cold Facts.

[2]C. V. Heer, C. B. Barnes, and J. G. Daunt, The Design and Operation of a Magnetic Refrigerator For Maintaining Temperatures Below 1° K, The Review of Scientific Instruments, Vol. 25, No. 11, pp. 1088-98, Nov., 1954.

Tests of Refrigerated Truck Trailers



Close-up of an experimental tractor showing added refrigeration and electrical equipment for road tests.



Backing one of the three specially equipped tractor trailers into the NBS test site. At left is pictured one of the sectional, portable heat-sink apparatus and the insulated test structure.

▶▶▶ REFRIGERATED TRAILER heat gain studies reported in INDUSTRIAL REFRIGERATION, January 1958, are now well under way. Combining in the National Bureau of Standards project to develop a method for determining the cooling load of refrigerated trailers, is United States Department of Agriculture, the Quartermaster Research and Engineering Command, Truck-Trailer Manufacturers Association, and NBS. As explained in the earlier coverage, objective is development of a standard laboratory rating method which will adequately simulate heat transfer conditions as actually encountered.

Results to date show pretty conclusively that the laboratory methods must include the means for simulating air leakage that occurs while a vehicle is in transit. Significant reductions in heat gain can be achieved if air leakage can be eliminated. Cooling loads of typical trailers have been compared in the laboratory and on the road in this project. Solar radiation and wind pressure are to be simulated in order that air and moisture transfer processes through trailer walls can be investigated in a practical manner.

Standards Non-Existent

There is no standard method of common use at present to actively determine the refrigeration load on a truck trailer. Development of an accurate method would enable trailer manufacturers to establish a rating for each model produced. Purchasers, knowing of such a rating, the product load of the commodity for transport, the length of the haul and the environment, could select specific refrigerating equipment for their transportation needs.

Laboratory Equipment, Procedure

An insulated structure equipped with special humidity and temperature controls and facilities was set up for a laboratory. Three 35-foot refrigerated trailers were placed in the building on calibrated platform scales. The scales determine weight gain caused by condensation of infiltered moisture.

Adjoining the insulated structure is a room equipped with considerable controls and instruments. Outside the test structure is installed prototype comparison heat-sink apparatus which consists of three motor driven two-speed compressors with water cooled condensers, two brine chillers and a metered heat comparator. Apparatus is sectionalized and semi-portable.

Refrigeration within the trailer is accomplished with an integral blower coil placed above the trailer bed as in most trailer refrigerating units. Excess cooling of the refrigerating unit is counteracted by an electric space heater when needed during the test procedures.

To measure average interior and ambient temperatures, thermocouples were placed inside and outside the trailer near the wall surface. Several large fans were placed within the test structure in order to assure uniform ambient temperature and humidity. Standard test conditions of O F inside the trailer and 100 F with 50 percent r.h. outside the trailer were set on the controls and the equipment adjusted to maintain these conditions.

Determining Cooling Load

Unknown cooling load of the trailers is determined by equating the ratios of inside and outside temperature rises, and the heat energy sources of chilled brine and electric heater. Temperature rises in the brine are produced by heat absorbed inside the trailer. The brine is circulated at a constant rate through the cooling coils inside the trailer and around the electric heater outside the trailer.

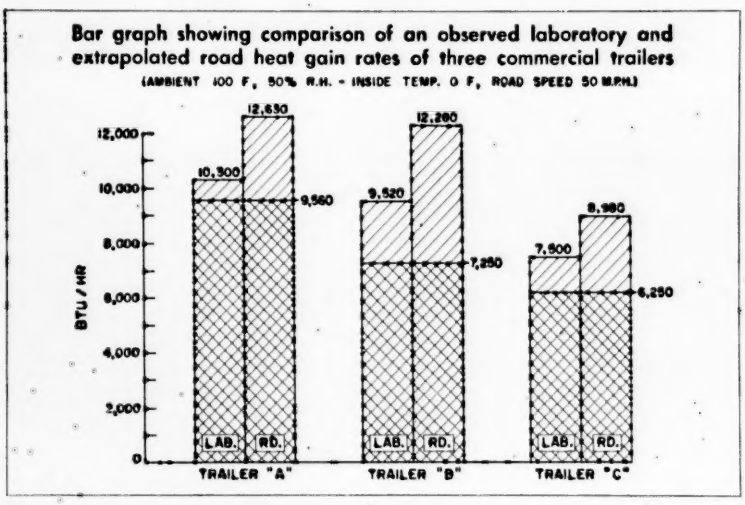
Tractor Carries Test Gear

For the road tests, a tractor was altered to carry a 2-stage gasoline engine driven refrigerating system, and an electric generator also gasoline driven (see Figs. 1 and 2). Controls and instruments were mounted inside the cab. Cooling load was determined again by observation of chilled brine circulation rate and its temperature rise inside the trailer, plus the electric energy required inside the trailer by the fans and other equipment. Road tests were carried out at 50 mph road speed.

Test Results

Results of these tests suggested that smaller refrigerating units could be used if air infiltration into the trailer structure could be eliminated. Also, less insulation would be required if air leakage is reduced. And, if moisture is kept out of the insulated space deterioration of the trailer would proceed more slowly.

Air leakage into the trailer structure is increased under impact pressure of air against the front of the trailer while on the road. This accounted for an increase in heat gain on the road as compared with results in the laboratory. However, air leakage and ice accumulation in the trailers were not negligible even under the stationary laboratory conditions. Weight gain rates caused by



ice accumulation averaged nearly 1/3, slightly over 1/2 and nearly one lb/hr, in the three trailers during the laboratory tests.

On the basis of air leakage into the trailer at ambient and leaving the trailer body saturated at 0 F, the air leakage rate and heat transfer to the cooling unit was computed for each trailer from the rate of weight gain. On this basis, the minimum laboratory air leakage rates were 235, 395, and 715 cu. ft/hr with corresponding heat transfer values of 740, 1250, and 2270 Btu's/hr.

In the meantime air leakage rates for the road tests, based on an assumption of heat transfer other than air leakage being the same as in the laboratory, showed a heat gain due to air leakage ranging from 32 to 69 percent. These percentages indicate that elimination of air leakage in trailer bodies would produce significant reduction in cooling loads.

Other Factors

Solar radiation effect is largely nullified by rapid air motion over the vehicle at 50 mph. In a typical test on the road in bright sunshine, surface temperature of the roof and one side of the trailer is about 7-1/2 F above ambient. This corresponds to approximately 3 F in temperature for the entire exterior surface. However, sun quite often raises the roof temperature by as much as 25 F.

The underside of the trailer warmed up as much as 15 degrees above ambient temperature during road operation, principally by waste heat from the tractor engine. This rise would not cause a very large increase in over-all heat gain of the trailer unless chilled air were circulated around and under the load.

Point Of Leakage

Greatest impact air pressure at 50 miles per hour incurred on the nose of the trailer which was not shielded by the tractor. The leakage air probably entered the trailer body on the nose and left the body of the remainder of the surface. Most of the moisture in the ambient air was deposited as ice in the insulation space. The air exchange between the insulation space and the outside was several times greater than between the cargo space and the outdoors.

This article is based on Summary Technical Report 2258 of NBS, USDC. For further technical information readers can obtain "Cooling Loads of Refrigerated Trailers under Laboratory and Road Conditions," Bulletin AMS 250, Agricultural Marketing Service, USDA.

Hitch-hiking Pounds

▶▶▶ TRUCK BUILDERS Rout Hitch-hiking Pounds was the title of a 4-page article in the ALUMINUM BULLETIN, Summer of 1958. First glance at the illustration would lead refrigeration engineers to believe that the article would deal with semi-trailer construction. However, the treatment actually dealt with aluminum applications for the tractor trailer.

While the companion article on these pages would indicate that certain polyethylene, vinyl or "Mylar" film combined with aluminum sheeting would do much to prevent vapor transmission, and aluminum construction reduce weight, the refrigeration engineer can take a cue or two from tractor developments reported in the article. Aluminum applications in engines could be applied to compressors, and cab features and to evaporators and condenser construction.

Aluminum Reefer Cars To Canadian National

▶▶▶ FIVE ALL ALUMINUM refrigerator cars are now in service with Canadian National Railways. They are believed to be the world's first. Designed by CNR, Alcoa of Canada and National Steel Car, and built by the latter, they are reported as being 22-1/2 percent lighter (14,200 lbs.) than previous refrigerator cars. With exception of trucks, door and hatch hardware and certain safety equipment they are entirely aluminum.

The purpose of extensive aluminum use is reported as a primary attempt to eliminate expensive and frequent repairs and repainting due to salt corrosion. Roof sides and ends of the 5 cars have been left unpainted. Previously, an experimental car had used aluminum for end and side construction. Prior to that in Canada, Germany and the United States aluminum had been used for roofs and interiors only.

Iron Curtain Foods Piggy-Back To Britain

▶▶▶ HUNGARIAN version of American refrigerated piggy-back or roll-on roll-off transportation will be used to send perishable goods to Great Britain without reloading at channel ports. First piece of such equipment, called the railway goods wagon, manufactured to international standards, was completed in September at Gyor Wagon Works. Thirty more are scheduled for completion this year. These refrigerated wagons are loaded on railway flats and then loaded directly on ships for the channel crossing.

Parking Garage Air Conditioned

▶▶▶ OFFICE TENANTS in the Universal Building, District of Columbia, which is to open in January, will have air conditioned parking space. A business man leasing space in this building can leave his air-conditioned home, drive to his office in an air-conditioned automobile, park it on the same floor level with his office, step out into an air conditioned garage atmosphere and proceed a few feet to his air-conditioned office. Releases on this story indicate that the garage, which has been the last gap that separates the business man from an entire day of air-conditioned comfort, has now been bridged. What about the golf links?

Practical Engineers Emphasize Leadership, Training

Scene of 49th Annual Meet—The Kirkeby Operated Kenilworth Hotels

ADD TWO MORE REGIONAL VICE-PRESIDENTS, EXTEND EDUCATIONAL SERVICES

▶▶▶MEETING in Miami Beach, Florida, last month the National Association of Practical Refrigerating Engineers elected new officers, expanded their regional officers staff and extended their educational services. Elected president was Roy T. Burns, retired Sr. Asst. Mechanical Engineer, Department of Buildings and Safety Engineering, City of Detroit.

John N. Mariakis, was advanced from 2nd to 1st vice-president, and M. E. Bell, director, was elected 2nd vice-president of NAPRE. The new board of directors established a precedent by appointing two additional vice-presidents and outlining duties for all four, in a move to encourage regional NAPRE activities and improve the educatonal servces to members. Appointed 3rd and 4th vice-presidents were S. Milton Rambo, formerly a director, and Falconer Anderson, a Northwest member, prominent in the Olympia Chapter and regional affairs in that area.

Kenagy Board Chairman

Leland Kenagy, treasurer of NAPRE for 12 years, was elected chairman of NAPRE's board of directors. He was succeeded as treasurer by Quaid Minich who had been membership chairman last year and active in the reorganization of the Greater Metropolitan New York group. Re-elected as secretary was J. Richard Kelahan, but the board of directors did not fill the executive secretary position for the present. New sergeant-at-arms is Louis W. Howat of New Orleans. Other directors remain the same, except Frank L. Chase, the retiring president who automatically succeeded Bert C. McKenna as educational director of NAPRE. The past president by precedent serves another year on the board and generally is assigned to this duty by the board of directors. (Complete list of officers and directors on page 24.)

Burns, the new president, announced that in addition to the official organ, the annual yearbook and educational benefits available to the chapters, the Association this year would include an elementary electrical course started late in 1958. Three direct mailings will be made to the members, covering the 4th, 5th and 6th sections of the electrical papers. This is a course developed by NAPRE nearly 25 years ago and revised in 1958 for the modern applications found in refrigerating plants today. First three chapters of the course were published in the NAPRE Operating Data Book, 1958.

Supervision And Training—Convention Theme

Theme of the 49th Annual Meeting as reported in IR last month, was Supervision and Training—The Chief Engineer's Responsibility. Speakers appearing at the various educational sessions geared their comments to that theme. Among the speakers were Wallace M. Smith, Tech. Service, General Chemical Div., Allied Chemical Corp.; M. E. Nicklin, Witte Engine Works, Oil Well Supply Div.; T. H. Rea, Armstrong Machine Works; D. D. Wile, Recold Corp.; Guy R. King, Instructor, Santa Monica City College, and John H. Dowling, "Freon" Products Div., duPont.

Mid-meeting special was a three-part post-luncheon presentation on management-engineering relations, on supervision and training, and on safety, which featured three speakers of national prominence. Professor W. R. Woolrich, Dean Emeritus, University of Texas, Daniel M. Roop, Supervising Engineer of the Baptist Memorial Hospital, Memphis, and John H. Herzog, Chief Engineer, Burgermeister Brewing Co., San Francisco, made the addresses.

The usual busman's holiday for these engineers was in the form of a field trip to the Velda Corp., Uleta, and a combined tour with the ladies of the Royal Castle Systems' meat plant and bakery. The engineers also made a tour of the heat pump installation in the Kenilworth House.

Speaker's Topics

"Pay Attention to the Details" was the title of Wallace M. Smith's talk. Presentation reviewed basic concepts of moisture, oil, heat and fluorinated hydrocarbon refrigerants as combined in a refrigeration system. An example was given in which some of the rudiments of good practice were not observed during installation and initial operation. Facts and figures illustrated the financial folly of ignoring details.

W. M. Smith

M. E. Nicklin

D. D. Wile

T. H. Rea

G. R. King

"Dependable Diesel Power for Mechanical Refrigerator Cars" headlined the talk by M. E. Nicklin. Railway mechanical refrigeration is one of the newest and most fascinating of applications for diesel engine power which has appeared on the industrial scene. Its identification with the food industry, the national economy and well-being, provides a never-ending challenge.

In this non-technical paper, the writer dealt wth the original requirement and showed how industry thinks and works when a new and untried field of application has to be explored and fulfilled. Surveys and analyses are made to determine the basic requirements of power and performance. This is followed by actual field tests which prove the basic items of equipment adaptations, accessories.

Questions to IR Prompted Two Speakers

Two questions appeared in the INDUSTRIAL REFRIGERATION Question Box in 1958 as follows: When an automatic purger is used, is a purge connection from both the receiver and the condenser required? Or, is the purge connection from the receiver only—sufficient?

Nearly half of the replies favored receiver purge only. Other engineers have purge connections from both condenser and receiver. The size and shape of the liquid line from the condenser to receiver, as well as the size and location of vent lines, influence need for condenser purge.

Where two or more condensers are used there is a possibility of unequal condenser pressure drops, making a purge connection from each condenser desirable. Condenser purge connections also are recommended on halo-carbon refrigeration systems. For hydrogen purge a connection from the top of a shell-and-tube condenser would be needed.

D. D. Wile supplemented the talk by T. H. Rea giving a purpose to purging. NAPRE members have their own opinions on where to purge ammonia refrigeration systems and these opinions are not in complete agreement. Wile showed why non-condensable gases can collect at various places in the system depending upon operating conditions. Even the same refrigeration system may collect non-condensables at one place during the Summer and at another place during Winter operation.

Wile then moved into the area of oil separation and promptly initiated

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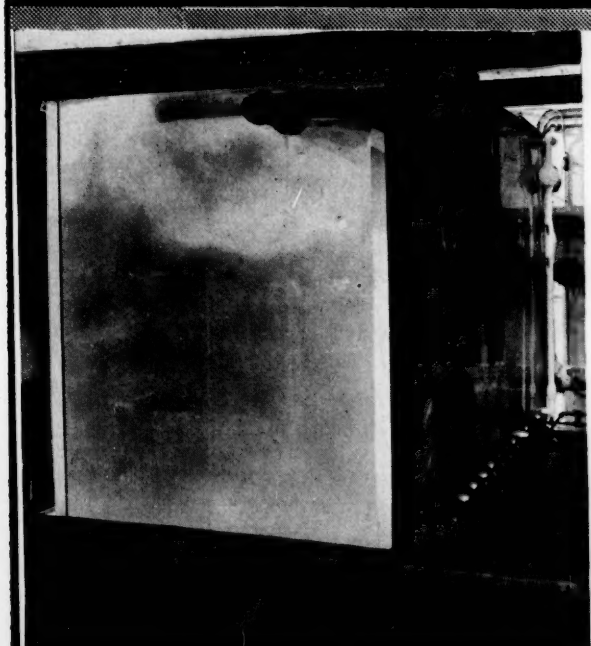

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NAPRE Midweek Convention Luncheon Figures: Frank L. Chase, Pres.; John H. Herzog, Safety Speaker; Dean W. O. Woolrich, Keynoter on NAPRE's Responsibilities. Jack Sawyer, Armstrong Cork Co., Sustaining Industrial Member of 1958; Dan Roop, Lecturer on Supervision and Training; Roy T. Burns, '59 Prexy.

as much discussion as had taken place over the topic of purging. It appeared that oil separation will probably be a prime topic for the next NAPRE national meeting.

King Speaks On Air Conditioning

Guy R. King, author, Basic Refrigeration, the official text of NAPRE, headed his paper as "Air Conditioning—What Is it?" According to King, there have been good practical men who consider air conditioning so involved that it can only be understood by a technically trained engineer. There have also been men who want the complete story of air conditioning in one easy lesson. As is usually the case, the actual falls between these two extremes. Since NAPRE cannot give all the information and training which the practical man should have in one easy lesson, King outlined the various subjects involved, and gave a few pointers on each.

ASHAE Definition

Air conditioning is defined by the American Society of Heating and Air Conditioning Engineers as "The simultaneous control of all, or at least the first three, of those factors affecting both the physical and chemical conditions of the atmosphere within any structure. These factors include temperature, humidity, motion, distribution, dust, bacteria, odors and toxic gases . . .".

Each of these factors were then taken up individually. Enough information should be required on each King said, so one can at least know some of the problems involved, even if he cannot supply all the answers. References were given as to where some of these answers are obtained, for those members who would like to study further the factors involved.

New Cleaner Introduced

No NAPRE convention is complete without the introduction of a new system, machine, process or application. This year a new maintenance supply was introduced by John H. Dowling. He demonstrated how to gain greater operating efficiency and longer useful life from electric motors and generators by proper cleaning maintenance. He pointed out that it is sound practice to keep the windings of electric motors and generators free of oil, grease and solid particles. The presence of these soils overheats the insulation, causing power losses and reduced insulation life.

According to the speaker there are many procedures for cleaning motors, but there is great danger of causing insulation damage in many of them. "Freon" motor cleaners are proposed, where applicable, as a solution to the problem of removing soil, yet not damaging insulation, varnishes, etc. They are particularly applicable for "cleaning-in-place."

Woolrich Urges Continuous Upgrading

The message from Dean Woolrich was inspirational in nature. He said if the United States is to take its place as the world leader of scientific and engineering achievement in design and production, its manpower teams made up of scientific researchers and investigators, engineering designers, technical maintenance operators and tradesmen, that all groups of this team be upgraded in both the *know-why* and *know-how* of industrial and scientific production, operation, and management. International competition demands that those highly important manpower teams should be individually educated for their tasks, and through their voluntary cooperation accomplish their goal of par-excellence more effectively than the directed men behind the Iron and Bamboo Curtains.

In the face of this world contest we call the recognized refrigeration industry, the members of the NAPRE constitute entrusted men holding the key positions of operation and maintenance. It is upon men of their technological education that actual turning of the wheels of production must depend. As the entire manpower team of refrigeration revolves around these key men of production, operation and maintenance, they in turn must experience more education and training in the advanced technology of the hour, as must the other team groups.

Leadership Emphasized

Expanding on the convention theme and the remarks by Woolrich, Dan Roop offered the following: Industrial and institutional plants of today, both old and new, have become complex operations with their machinery; all requiring constant surveilance by engineers and personnel adequately trained to protect the owner's investment.

Management cannot economically and morally justify such capital expenditures unless it is willing to protect them by establishing an organization of personnel equipped with the techniques of leadership and management necessary to perform all the functions required for the preservation of these physical facilities, said Roop.

"Safety and Accident Prevention in Industrial Refrigeration Plants" was the topic of John Herzog. He outlined required safety measures and set up some of the prime regulations and standards for installation and operation of refrigerating equipment. He related case histories of serious ammonia explosions which are resulting in re-evaluating the critical danger zone (percent of concentration of ammonia mixed with oil and air).

Industrial Members Have Their Inning

Newest in the NAPRE family is the Industrial Member. However, for the third consecutive year new Industrial Members were introduced and all were afforded an opportunity to enlighten the delegates and guests on new developments by their respective firms. Herb Rosen of H. A. Phillips & Co. presented members with a new booklet covering the installation, operation, and maintenance of liquid return systems.

This booklet condenses this firm's 12 years of experience in application of such systems in industrial and food processing plants. The subject matter covered experience with liquid ammonia applications, accumulators,

Herzog

Laverty

Roop

Dowling

Woolrich

dump traps, and the associated check valves, hot gas solenoid valves, magnetic float switches, liquid pumps, and the control and alarm circuits.

The Vilter Manufacturing Co. was represented by Irving Weinberg, their Atlanta District Manager. Weinberg went into the Whys and Wherefores of Vilter Refrigeration Equipment Design. The major item of equipment, described is the VMC compressor. Concluding the presentation were a few remarks on the VSC and VXF evaporative condensers.

Industrial Member Recold Corp. was again represented by D. D. Wile, who presented three new lines of products that were particularly significant to NAPRE members. Dri-Fan evaporative condensers, Vapomatic defrosting for ammonia, and a new oil separator developed by Recold for use with their evaporative condensers, were discussed.

A new concept in cooling towers was presented by W. E. Kahlert representing Baltimore Air Coil Co., Industrial Member. The new unit is called a Flexi-Tower. Kahlert described how the new tower is a result of a five-year research program involving $150,000.00 and 800 laboratory tests. Capacity control came in for considerable discussion with the practical engineers.

Winding up the Industrial Membership presentations was J. P. Sawyer, manager, low temperature insulations, Armstrong Cork Co. Sawyer presented a discussion of physical properties and practical uses for Armstrong Armalite, a foam polystyrene insulation. Like all the Industrial Members, Armstrong presented reproductions of their representative's paper to the members present.

Velda Operations

Major field trip event of the NAPRE meeting was the trip to the Velda Corp. This plant was described in INDUSTRIAL REFRIGERATION (June 1958, Page 11). Hugh Muller, chief engineer, was host. He and his staff made the visitors more than welcome. The triple-staged ammonia plant was considered a bit unique by most of those inspecting the plant.

Visitors Introduced To New Continuous Package Freezers

Parallel feature of the Velda NH_3 plant was the opportunity to observe first-hand the operation of two continuous package hardening systems for ice cream manufacturing. The first automatic package system was put into operation at Velda in 1950. Second was put into operation last year and is capable of handling half gallon packages of ice cream. Extreme compactness of this unit allows space requirement to be cut almost in half as compared to continuous belt tunnels. Detailed inspection of the operation of the units, including electric and hydraulic controls was made possible through the cooperation of George R. Wachter, Vice-president, FES, and some of his engineering staff who were on hand.

Heat Pump System

Hill-York heat pump system in the Kenilworth House is approximately 150 TR of reverse cycle refrigeration which differs from other heat pump units in many respects. The system basically takes heat or energy from the unlimited supply of underground ocean salt water, eliminating all requirements for any heating boilers for hotel comfort heating. At the same time, the same system supplies all condensing or heat discharge needs, eliminating cooling towers. R. S. Laverty, Hill-York, designer of the installation, led the discussions.

This system gives the greatest flexibility yet designed for a centralized system inasmuch as any room could be heated comfortably while any other room, either adjoining or across the hall, having either sun effect or internal heat, could have cooling or dehumidifying. To accomplish this purpose are various sizes of sealed circuit water cooled reverse cycle units and a special marine type heat exchanger to make close transfer temperature difference between salt water and fresh water at a low pumping head. The result as experienced has proven extremely efficient for both cooling and heating seasons.

Third field trip of the day on Wednesday, November 12, was the tour of the Royal Castle System, Inc. Those making the tour met in air conditioned comfort in the firm's auditorium and then inspected the air conditioning plant. A tour of the bakery was made where coffee and donuts were sampled, followed by an inspection trip through the meat cutting plant. Complete details of the refrigeration systems serving this facility will appear in an early issue of INDUSTRIAL REFRIGERATION.

Social Program

It wasn't all work with the engineers. Each evening a social event was enjoyed. On Tuesday night, November 11, the members went on a moonlight Biscayne Bay excursion on a pleasure boat chartered exclusively for NAPRE members and guests. Following the plant inspection at Royal Castle System, Inc., the conventioners went on a sightseeing tour of the glamorous Miami Beach night clubs and hotels. On Thursday evening, November 12, the Association held its annual officers' reception, followed by dinner, installation of the new officers, dancing, entertainment.

The ladies were entertained Tuesday with a luncheon at the Diplomat and on Wednesday with a cruise through the Everglades to Fort Lauderdale. At noon they lunched in Creighton's Restaurant a famous spot for its antiques and objets d'art.

Membership Contests

Membership Chairman, Quaid Minich announced the winners of the 1958 membership contest at the annual dinner of the association. Taking the Emerson A. Brandt award was Dallas Chapter, which showed the best over-all effort in membership renewals and new members. The large chapter trophy went to Los Angeles Chapter which now has a second leg on this award. The small chapter trophy went to the newly reactivated chapter in Metropolitan New York. Virgil Young, George Paulick and Wally Smith were the three respective chapter representatives who accepted the awards.

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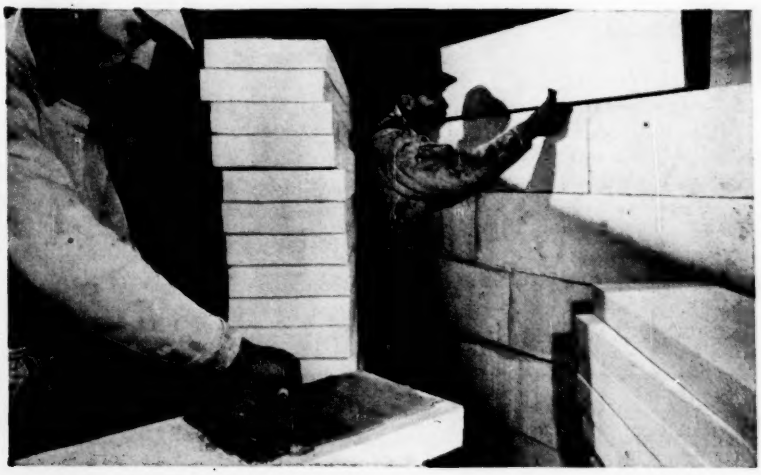

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What Is Power Factor

By B. L. BRITT

1. What is meant by power-factor?

Power-factor is an engineering term referring to the percentage of the total electric current in any alternating-current circuit which is other forms of energy—chiefly useful work, but also heat losses, etc.

2. Why, in alternating-current circuits, cannot the total current be transformed into useful work?

Because certain apparatus used in such circuits must be put into a certain state, described by saying they are magnetized (the core iron of motors, etc.) or excited, before they will perform their useful work; and this process of magnetization is accompanied by a current in the circuit, which is quite distinct from, and additional to, the current which represents the actual work that is being done.

3. What are the characteristics of this magnetizing current?

Precisely like those of the working current except that the magnetizing current does not directly require the expenditure of mechanical energy to maintain it—beyond its transmission losses. Magnetization of iron or steel occurs quickly but not instantly—there is a slight lag. Energy absorbed by magnetization from one impulse of alternating current is the circuit by demagnetization so there is no energy consumption—but because of the slight lag, the magnetizing current is out of step i.e., it lags behind the working current, by an amount which engineers call ninety electrical degrees.

4. What is the result of the combination of the two currents?

We were all taught in high school that any given force can be resolved into two forces acting at right angles (that is, ninety degrees) to each other—these two forces being the components of the total (resulting) force. Just so, the line current (amperes drawn by a motor) is the resultant of the working current and the magnetizing current components, operating at right angles to each other. Graphically it can be depicted by a right angled triangle in which the sides are of lengths corresponding to the working and the magnetizing components respectively; the hypothenuse will measure total current.

If there is no magnetizing component in the line current, the power-factor is 100 per cent and the total current is identical with the working current, and in step with the voltage.

The condition prevails in the operation of incandescent electric lighting, of heating apparatus, and of certain types of motors.

In direct current operation this condition always prevails, the power-factor is 100 per cent, the magnetizing current is in step with the voltage, and therefore included in wattmeter and watthour meter measurements.

5. Is the magnetizing current of induction motors in step with the voltage (also called the electromotive force or line pressure)?

No, the working current alone is in step with the voltage. The total line current is also out of step with the voltage, but not so much so as the magnetizing current.

6. What is the derivation of this idea that there are two kinds of current?

A typical electrical circuit consists of a generator (driven by steam or water power) connected by cables and transformers and wires to motors; if we apply power at the generator shaft we can take power out at the motor shafts, and the difference between power put in and power taken out is explained by the transmission and conversion losses, which reveal themselves in heat.

But, the readings of current-measuring instruments—show there is more current present than the amount of power, either put in or taken out, accounts for. This fact demonstrates that there are two currents in the circuits at the same time, operating jointly—the working current corresponding in amount to the actual work being done, and the magnetizing current corresponding to the magnetic effect of the circuit—and that the total current passing and as recorded by the instruments, is precisely the combined effect of the two.

When we talk of magnetizing current, therefore, we are talking of a current that is mixed with the working current; but we may, nevertheless, proceed as if it were a definite, distinct reality. We then obtain an entirely satisfactory picture of existing technical facts.

7. Is it possible to distinguish between the working current and the magnetizing current with measuring or recording meters?

Yes, with suitably selected meters, the working current and the magnetizing current can be separately measured and distinguished for commercial rate-making or for engineering purposes.

These questions and answers were published in REFRIGERATION SERVICE AND CONTRACTING magazine, September 1958. NAPRE's Educational Committee appraised the work as an excellent piece of educational material and suggests it as bibliography for the current Basic Electricity Course being published by the Association. Replying to a question raised by one of the officers, the following was received from W. L. Tiffin, an electrical engineer member of the Chicago Chapter, who assisted in the review:

"We feel that the answer given in connection with question No. 9 is perfectly satisfactory and, actually is probably the point of most interest to the power user. The only other point which might particularly be of interest to the power user are cases where the serving utility bases its billing rate on the actual plant power factor. This billing rate is purely a local matter and individual utilities have different ways of applying the penalty. A request to the utility would bring a local user all the answers he would need on this point".

An Analogy of Power Factor

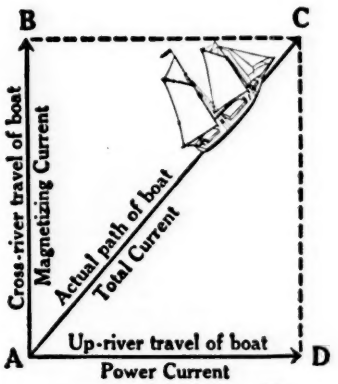
8. Give a simile that will help one to understand magnetizing current and power-factor.

Compare the power system to what a sailor does when he wants to sail against the wind. He tacks; that is, takes a zigzag course.

He has no desire to sail across but must tolerate this cross travel in order to keep his boat in a position to catch and use the force of the wind. It is the only way he can sail against the wind.

Similarly induction motors require magnetizing current to place them in a condition to develop power. This necessitates a current at right angles to the power current. No one wants this magnetizing current but, like the cross wind of the sail boat, it is necessary.

This comparison is almost a perfect analogy as can be seen from the illustrated analogy of power factor. The only difference is that in the case of the boat we are dealing with space relationships; in the case of electricity with time relationships.



POWER-FACTOR = $\frac{AD}{AC}$

Electric Motor (Power-factor less than 100%)	Sail Boat (Sailing against wind)
Power – Motor requires power current (AD) in the same direction as the voltage. **To do desired work**–Necessitates placing motor in condition to develop power. This requires magnetizing current AB at right angles to power current. **Actual Current**–Actual current is AC, being the geometric sum of AD and AB. **Power-factor of System**–is equal to power current AD divided by total current AC.	**Effective travel**–The only effective travel is that in the direction (AD). **To do desired work**–Necessitates keeping boat in position to utilize the force of the wind. This necessitates cross-river travel AB. **Actual Travel**–Actual travel is AC, being the geometric sum of AB and AD. **Effective travel-factor of Boat**–may be said to be travel AD divided by total travel AC.

9. In what form does low power-factor show itself?

In an abnormal falling off in voltage all along the system, down to the point where power should be delivered at full voltage.

10. What kinds of apparatus require magnetizing current?

Transformers, electric welders, electric furnaces and induction motors are the types of electric machinery requiring large amounts of magnetizing current.

11. Which of these is of the most importance in the problem?

The induction motor, because it is so universally employed by users of alternating-current power. As a mechanical device, the induction motor is an efficient piece of apparatus and an indispensable tool of industry; but it requires a supply of magnetizing current to operate.

12. Does the amount of magnetizing current needed by a motor depend upon the amount of work it is doing?

The amount of magnetizing current required by a motor is determined by its design. Low speed motors always require relatively more magnetizing current than those operating at higher speed; and small horsepower ratings relatively more magnetizing current than those operating at higher speed; and small horsepower ratings relatively more than larger ratings. Broadly speaking, the magnetizing current requirement for any particular motor does not vary greatly whether it is running fully or lightly loaded; a point often overlooked.

13. What is the effect of this on the power system?

When most of the motors on the system are running at less than their designed load, the proportion of magnetizing current becomes unduly large, and this, in industrial plants, is almost always the case.

14. What are the better methods of supplying magnetizing current, from other than the generators?

There are two types of apparatus which have a property that may be described, for practical purposes, as that of supplying magnetizing current to the system, instead of drawing magnetizing current from it. They are. (a. capacitors; (b) synchronous apparatus.

Practical Refrigeration Engineer

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All refrigerating engineers are invited to affiliate with the National Association of Practical Refrigerating Engineers, Inc., an educational association, "not-for-profit".

From the President's Desk

NEW PREXY SETS OBJECTIVES

Extends Greetings In First Message

Roy T. Burns

▶▶▶ FORTY-NINTH Meeting of NAPRE is history. Your new national officers and directors of NAPRE, along with the membership, are looking forward to another successful year for NAPRE in 1959. Financially the Association is better off than in the past several years previously and new educational materials are in the making for the Association.

Before details are spelled out, it is best that your new President express his appreciation for the confidence placed in him through your nomination and election as the NAPRE's chief executive. It is your President's pledge to do everything in his power to see NAPRE grow and he does so with the knowledge that each member will back him up in every effort of the Association.

Educational Objective

Principal purpose of NAPRE is education—not so much from the school-going prescribed course for a certificate or degree, as from the practical adult point of view. This should always be the guiding factor for our chapters in setting up their annual programs. As a general thing most chapters have planned their 1959 calendar, but to those which haven't your new President adds the encouragement to follow such an example for a successful year.

The educational committee in 1959 will be under the directorship of past president Frank L. Chase. Assisting him will be Dean Harold P. Hayes and Professor Guy R. King. As in the past, Hayes will supervise and guide the Question Box activities nationwide and King will assist the chapters in preparation of their programs and calendars. A third educator is to be added to our staff in the near future who will directly supervise the convention educational program in 1959.

Reinstatement Drive

As happened in most organizations, NAPRE suffered a slight decline in membership in 1958. It is attributed both to economic conditions and to the increase in dues, which amounted to 20 percent. However, with current invoicing for '59 dues it has been noted that a number of withdrawals have recognized the fact that a dues increase was unavoidable.

A very nominal fee enables these engineers to reinstate through their chapters or as members-at-large. A fee is necessary since a certain amount of clerical work is involved in reactivating the member's card and the Association will endeavor to provide a few back sections of the current Basic Electricity Course. Even an Electrical Protection Handbook is offered as an inducement to reinstate!

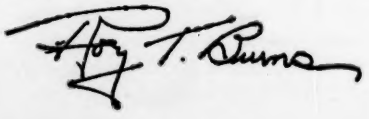
New Member Goal

While the chapters are on the conservation effort, it should not be forgotten that many engineers have heard of NAPRE and will join if invited. Everyone likes to be asked to do something and very few engineers will initiate an action on their own when it comes to joining an organization of any kind. NAPRE's goal for the completion of its 50th year is 6000 members. This goal can be achieved by the time of our Annual Meeting in 1960.

Venemann Fund

It was very encouraging to learn again this year that the Los Angeles Chapter was asking for voluntary contributions to the Venemann Memorial Loan Fund. The second largest chapter of NAPRE indicates on their dues invoices annually that a member can make a contribution when remitting dues. Over three-fourths of the chapter members contribute $1.00 or more in this manner.

The pleasure of your new President is doubled in this the first message, by the opportunity to wish all a very Merry Christmas.



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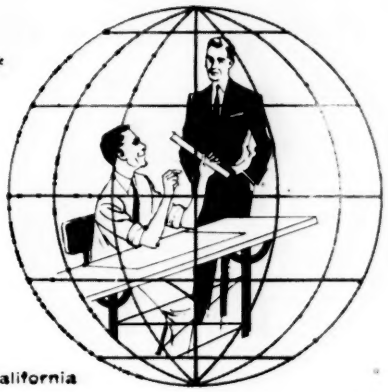

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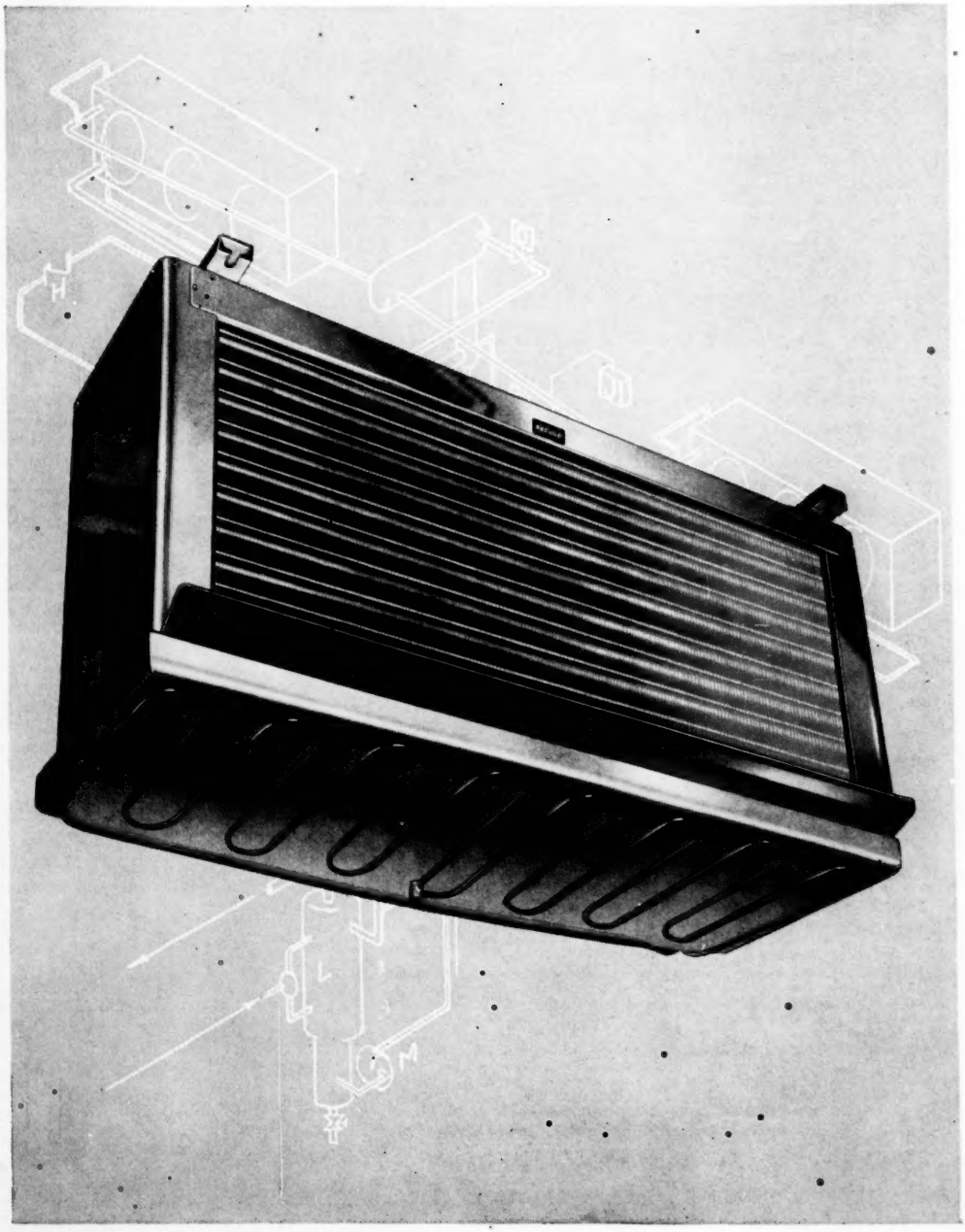

NAPRE CHAPTER NEWS-EVENTS

Madison Square Garden Host To NAPRE Meeting

NEW YORK CITY—Yes, that famous and well known arena, Madison Square Garden, where headline sports events, political conventions and other great organizations have held their meetings, was host to NAPRE Greater Metropolitan New York Chapter in mid-summer. The New York group didn't claim to have the numbers the many other organizations have drawn, but through the courtesy of Frank O'Sullivan, chief engineer of the Garden and Thomas Buckley, New York Chapter, members and guests saw more of the Garden than the average individual who purchases a ticket at the box office.

From exhaust fans and electronic dirt precipitators located high in the steelwork of the arena, to the boilers and centrifugal compressors in the basement, they saw it all and learned some of the working details from able guides headed by Buckley. This report won't confuse or confound the reader with a lot of statistics on Madison Square Garden heating and cooling capacity (don't remember them all anyway), but most subscribers have seen the tremendous crowds that have gathered at the Garden for some of the important events.

Circulating fans, ducts, heating coils, cooling coils and exhaust vents are so arranged that regardless of the type of event; whether a circus, an ice show, a convention, or a world championship fight, comfort conditions can be controlled more closely than most of individuals are able to do in their own homes. For up to 20,000 people—this takes some doing!

The floor of terrazzo can be converted from an ice show tonight to a circus (on a surface of dirt and tanbark) tomorrow night. Seating arrangements can be set for the Imperial Russian Ballet one night and changed over to the Stanley Cup play-off for ice hockey the next. This was one of the most interesting meetings of the year and New York Chapter extends thanks to Messrs. O'Sullivan and Buckley.

Fall Meetings Started

First Fall meeting of the '58-'59 term saw the membership reconvened at Seaboard Terminal & Refrigerating plant in Jersey City. The meeting was well attended and everyone had a good time. Most of the "regulars" were there, two new members and several visitors who seemed to enjoy efforts to help entertain and instruct the operating engineers in the area. The cycle of operations in the manufacture of artificial ice was demonstrated, from city water coming in, to the finished product, ice cubes. Free samples were distributed to all those who wished to take some home. Coffee and, — hot, strong and on time finished up the evening.—QUAID MINICHI

Michigan Tells Chapters Of National Help Offers

DETROIT—NAPRE has spent a great deal of money through its educational committee to provide program outlines and an instruction manual which can be followed by any inexperienced member if he wishes to participate in a program of this nature. Detroit is proud of the program they have offered over the past several years and although it is hard work, they sincerely believe that any other chapter in the United States can match their effort (see calendar, right).

Chapter Loses Gingrich

Bright Chapter lost one of its members in September with the death of Amos Gingrich. Gingrich was born in Defiance, Ohio. He started working there in the dairy industry. He moved to Detroit in 1941 and joined the Johnson Milk Co. Inc.

He was in the Armed Forces during 1943 and '44. After the war he returned to the Johnson Milk Co. as an operating engineer. Mr. Gingrich was 54 years old. He died of complications following an operation for ulcers. He was buried in Auburn, Indiana.

—L. L. ADAMS

Bright Chapter '58-'59 Program

Oct. 2—"Fundamentals and Refrigerants"
(Chapters 1 and 3 of Text Book)
Leonard Bedard, C.E.,
Henry Ford Hospital

Nov. 6—"Compression System of Refrigeration and Compressors"
(Chapters 2 and 6 of Text Book)
Boyd Kitts, Supt. of Maintenance
The Stroh Brewery Co.

Dec. 4—"Condensers and Flow Equipment"
(Chapters 7 and 8 of Text Book)
Richard Brand, Applications Engineer
Acme Industries Inc.

Jan. 8—"Expansion Valves-Evaporators-Controls and Control Valves"
(Chapters 4, 5 and 9)
David L. Falk, Registered Engineer,
Ind'l Applications Specialist

Feb. 5—"Lubrication-Compressor Drives-Instruments and Meters"
(Chapters 10, 12, 14, 17)
Boyd Kits, Supt. of Maintenance,
The Stroh Brewery Co.

Mar. 5—"Food Preservation—Servicing"
(Chapters 13 and 15 of text)
Norman F. Danaher, C.E., Borden Co.
Michigan I. D. Div.

April 9—"Refrigerated Enclosures-Heat Calculations-Humidity in Refrigeration-Brine Uses and Liquid Cooling"
(Chapters 16, 18, 19, 23, 24)
E. P. Callahan, Manager, Industrial Div.
Detroit Ice Machine Company.

May 7—"Compressor Calculations Refrigerant Line Pressure Drops"
(Chapters 20, 21, 22)
Wm. G. Euth, Refrigeration Engineer,
Euth-Lambrecht Co.

June 4—"Complete Systems-Codes and Regulations"
(Chapters 25, 29 of Text)
Roy Burns, Retired Senior Engineer
Bureau of Safety Engineering
Jim Rawsthorne, Applications Engineer,
Acme Industries, Inc.

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- These new vendors are now made in lengths up to 20' which will vend 268 10# bags plus 132-25# blocks out of the same delivery door, (400 Sales).
- Up to 5 various sizes of blocks or bags can be vended from this one vendor.
- Radical invention, trouble free, more storage space by design, lower operational cost.

NEW LOW COST 6' x 8' station vends 110-10# packages, or the "Junior", 3' x 7' station vends 90-10# packages using the new multi screw vendor.

ILLUSTRATED 9' x 16' Station vends 168-10# bags and 86-25# block.

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Refrigeration - Service to Humanity

H. THOMAS DEWHIRST, President
Fruit Belt Chapter, NAPRE

REFRIGERATION cuts across every aspect of modern life. It does a better job of cooling—and even heating now—than any previous method known to man. Altho other industrial applications loom large today and for the future, food preservation is its most important application and will continue to be—for longer than many today will live to see. That application brought NAPRE to Benton Harbor.

Benton Harbor and the surrounding areas are blessed with soil and climatic conditions, making this territory the outstanding fruitbelt of our nation.

In 1679 LaSalle set foot on the banks of the St. Joseph River, and, according to the military reports sent back to the King of France, this region was intended by nature for fruit production as he mentioned the profusion of wild grapes and other fruits he found along the banks of the St. Joseph River.

Over 100 years ago, a group of early settlers started to cultivate these natural resources, recognizing that the prevailing westerly winds across Lake Michigan were tempered by the miles of blue water. This condition eliminates much of the danger of frost chill to fruit in the springtime.

Largest Growers Market

In 1930, our Benton Harbor officials, realizing the immensity of this fruit industry purchased an 11-acre tract of land. This was the beginning of the present Benton Harbor Fruit Market, the largest cash growers market in the world. The market now covers 22 acres.

Soon after the market moved to their present location. There was a need for a cold storage. The House of David took on the responsibility of building the cold storage plant and today there are 10 large cold storages thru-out the fruit belt.

County Leads Nation

Berrien County leads the nation in the production and processing of small fruits such as raspberries, currants, Damson plums and dewberries; and, rates high on the list for peaches, blackberries, strawberries, cherries, pears, grapes and apples. The processors in this area paid the growers approximately $20,000,000 for their fruits and produce last year. This is in addition to the approximate $10,000,000 the growers received on the fresh fruit and vegetable market, and an estimated equal amount from sales made thru various fruit exchanges.

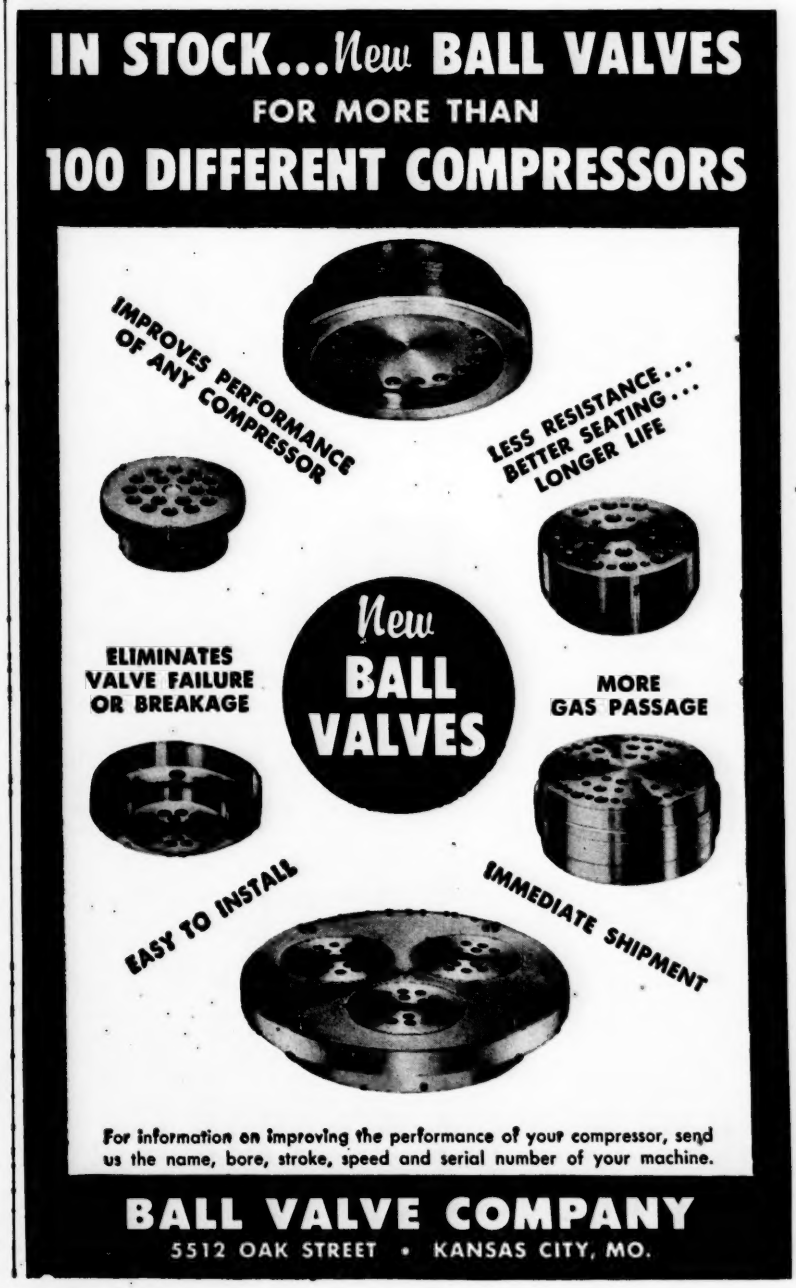
Of the fruits and vegetables grown in this area, a large portion are either frozen or stored at cooler temperatures. This is the portion in which members of Fruit Belt Chapter, NAPRE are particularly interested. One of the large consumer size packages is frozen concentrated fruit juices. Frozen strawberry, peach and numerous other fruits, also vegetable pies are being processed, as well as pie filling.

Frozen products play a big part in the preserving plants, soup companies, fountain supply and ice cream manufacturers. Some members are interested in the dairy industries. Other members are interested in industrial application, air conditioning, humidity control, chemicals and paper industry. Other members are directly concerned with the installation of all types of refrigeration and air conditioning systems. Beverage companies, wineries and breweries have found refrigeration and air conditioning a vital aspect in their processing.

Summarizes Other Uses

Refrigeration today affects nearly every individual, and has played a vital part in the history and development of many of the great new industries thru-out the U.S.A. Two- and three-stage compressors are necessary for low temperature refrigeration, and industrial and domestic refrigeration and air conditioning is an accomplished art. Reviewing, here are a few of the applications of refrigeration all of which require engineers to assure a good end product.

Address to North Central Regional Conference NAPRE, Spring 1958, held at Benton Harbor, Michigan, coincident with chartering of Fruit Belt Chapter.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Petro-Chemical Uses

Petroleum refineries have provided an increasing market for cooling processes, and in producing anti-knock gasoline. De-waxing is done with solvents at temperatures running down to minus 80 F. In some of the newer plants, refrigeration is being supplied at the level of minus 150 F. for this purpose.

The wartime expansion in the field of synthetic rubber was tremendous, and refrigeration played a most important part. Refrigeration is a necessary part of many chemical processes.

One of the largest installations of refrigeration equipment in the world is required for the ethyl-alcohol plant of the Shell Chemical Co. in Houston, Texas. This corroborates part of the Texas ego that everything that Texas does is big.

Safety In Processing

Cellulose is the raw material for a type of rayon, celophane and many plastics and lacquers. The common reactions of cellulose may easily proceed too far unless controlled carefully by refrigeration. Minor variations in the process may change the product from the base for fabrics, plastic or lacquer to an explosive.

Sports Applications

Artificially frozen sheets of ice called skating rinks have been installed in sport arenas where the "fields" are used alternately for ice sports, wrestling, and basketball. The ice rink can be frozen in a matter of hours.

The control of unstable and water bearing soil by freezing during a construction period has been in use for more than 50 years.

Industrial Uses

Industrial air conditioning and industrial refrigeration are often times very close together so that practically it is difficult if not impossible to separate them for discussion. In general, industrial air conditioning involves the treatment of air as regards its temperature, humidity, quality and motion, whereas industrial refrigeration involves the treatment of a product.

Too dry an air results in static electricity. This static electricity has resulted in the death of people during operations, in that the static sparks ignite the anesthesia (anesthetic), causing an explosion in the body,—therefore hospitals and operating rooms are air-conditioned to alleviate this danger.

In metal working, machined parts requiring close tolerances, parts made in various localities, or at various times of the year and which are to be assembled later, parts requiring several days to machine, and replacement parts need to be made in controlled constant temperature surroundings so as not to expand or contract unevenly. During World War II, the ordinance test-gauge rooms thru-out the country were held at 68 F the year round.

Air conditioning is used in safety glass manufacturing, matches, mushroom houses, pharmaceuticals, silk industry, tobacco manufacturing, and countless thousands of other industries, from Atomic Plants to the clothing we wear.

So, one may see that air conditioning plays a tremendous part in the great industries of America, not only in storing and processing of materials, but in work efficiency, safety, health and comfort of production personnel.

Food Preservation Tops

Refrigeration's biggest application is toward the most important thing in the existence of man—food. It is necessary to maintain frozen foods at below zero temperatures. Foods held higher than zero tend to become soft and flabby due to a breakdown of the food cells by icicles. Every change of 10 F temperature, changes the structure of the food cells, similar to the change of molecules in iron or steel when subjected to heat and cold.

Large castings of cast iron are dismantled by means of placing dry ice next to the casting, then with one sharp blow of a hammer, the casting shatters into thousands of pieces. In fact, this was being demonstrated in one of the foundries not too long ago. A foreman wanted to impress a new employee with his knowledge. The foreman gave the young man a hammer—then placed some dry ice next to the casting. He said to the young employee, "When I nod my head, you hit it with the hammer." The young man did as he was told—, and the company hired a new foreman.

The world pays very little for the person who is able to hit a blow with a hammer. It pays big prices and great homage to the person who knows where to hit. This special talent of knowing where to hit may come to a man at any age.

Refrigeration Improving

Refrigeration has been proving and will continue to prove that it can do a far better job quicker, safer, and as economically than any other previous method. Refrigeration not only stops food spoilage, but retards its rate of maturing, and thus prolongs its life. By proper freezing, we are able to retain original flavor, and texture of food, to a degree never before accomplished.

Refrigerated warehousing has prolonged the life of not only frozen foods, but is now extensively used in cooling and holding canned products which have been pasteurized and hermetically sealed (juices and berries). Grain foods, products containing nuts, and even candy are now made during the slack season,—and then stored under refrigeration in order to meet the peak season demands.

Each member of NAPRE in the Fruit Belt Chapter contributes greatly to the success of his growing industry by the careful watch and maintenance of equipment. Failure of equipment could have a disastrous effect upon the community and its growth, relative to our position as a leading area in the production of frozen fruits and vegetables.

Field Trip Opens Program Year at KC

KANSAS CITY—NAPRE's Chapter in this Kan.-Mo. area opened its 1958-1959 program year on Sept. 2 with a watermelon feast and field trip to the Argentine Plant of Railways Ice & Service Company. Lee Kenagy, plant manager and Chet Rose, assistant chief engineer conducted the group through the plant. Considerable interest was shown by the visitors—but for some it was just a visit to their old stomping grounds. A. C. Boyd and V. W. Crocker, chief engineers of two City Products Corp. plants in the KC area are former employees of the Argentine Plant. Another visitor was Roy Gallup, chief operating esgineer, U. S. Cold Storage, who is the son of Jim Gallup and was at one time chief engineer of the Argentine Plant.—J. MULLER.

Heat Pumps Discussed At No. California Unit

SACRAMENTO—First meeting of the fall season for Sacto Chapter was held at Sacto Jr. College, refrigeration engineering room. Educational program was taken over by Luppen & Hawley Corp., a local distributor-contractor. They were represented by M. J. Delevan and L. Orange who put on a very interesting program with lectures, slides, and charts showing the application, costs, etc.

Emphasized was the necessity of using more insulation than is customary for normal dwelling construction in this area; also the necessity of careful engineering in the sizing and installation of these units. According to their figures, it is economically practical to use heat pumps in this area.

Present at this meeting was Regional Membership Chairman, Leroy Etzel, a charter member of Calif. Chapter No. 3, now of San Francisco. He presented the National Trophy for the largest percentage increase in membership for small chapters which was won last year.

Majority of the members here are taking the night course in air conditioning taught by member, A. Q. Woodruff. Therefore, the Chapter only meets whenever an outside speaker can be obtained who has an interesting message for all concerned. All members and other students are invited to these meetings which are held on regular school nights.

—LEONARD T. DAVIES

Mile High Tour

DENVER — NAPRE's Rocky Mountain Chapter took a tour of the Mile High Center, 1700 Broadway, Denver, Colorado on October 2. Hugh Duggan, assistant chief engineer, conducted the tour. Visitors were amazed at the intricate electronic system and multiple installation of very large York centrifugal pumps. Duggan gave an interesting lecture accompanied by chalk drawings and later escorted the group to the roof top for a view of the City by night.

The Denver Chapter is honored to have as a new member, Dr. Walter Maclinn, Director, Refrigeration Research Foundation. —FRANK DIDONATO

Surface Condensation, Insulation Failure Preventable in Air Conditioning Systems

LOS ANGELES—Practical problems encountered in insulating various types of air conditioning systems was the subject matter of a talk presented at the October 1 meeting of Los Angeles Chapter, NAPRE, by James A. Crawford, Armstrong Cork Co.

Crawford reviewed the substantial growth in the number and types of air conditioning systems installed in new construction and modernization markets during the past several years. He pointed out that this variety of applications and rapid building growth has created some new installation problems, many of which have affected the insulation materials used for these systems. The speaker explained that in certain chilled water air conditioning installations, unexpected condensation or sweating had occurred on the insulation surface.

"In these particular cases," he said, "the sweating was not always the result of poor workmanship, low quality materials, or insufficient insulation. In fact, it is possible that two installations will appear identical as far as the person who is specifying or selling the insulation is concerned. Yet, when the two jobs are completed, one will be plagued with problems of sweat control, while the other is a complete success."

Similar Projects Re-act Differently

Crawford cited the example of a wholesaler who supplied the same material for two projects located in the same city. Both buildings were approximately the same size and were equipped with similar dual temperature, winter-summer air conditioning systems. There appeared to be nothing in either of these jobs to indicate that a severe sweat control problem existed. However, soon after the installations were completed, one failed badly! Damage accredited to the sweating of the air conditioning piping system amounted to $20,000. Study of such installations and others where similar problems existed, was the basis for Crawford's presentation to the NAPRE:

"When considering the condensation of air borne moisture, surfaces will sweat when the dew point (DP) of the air in contact with the surface in question is higher than the temperature of this surface," the speaker said. "In other words, an insulated chilled water line will sweat when the surface temperature of the insulation is below the dew point of the surrounding air."

Surface Condensation Facts

Crawford cited two major reasons for the unexpected sweating of an insulation which normally performs satisfactorily: First, the dew point of the air is higher than expected, or even higher than was measured at the location before the installation was made. Second reason for failure is that the insulation surface temperature is lower than would be expected from either past experience or calculations.

The speaker demonstrated his first reason for unexpected sweating by having his listeners examine a simplified psychrometric chart. An example made it clear what happens when water vapor is added to a particular sample of air.

"If air in a certain enclosure originally contained 106 grains of water per pound of dry air," he explained, "it would have a dew point of 69 F. If water vapor is added to this air by some means until it contains 126 grains of water per pound of dry air, the dew point will then be 73.8 F.

"If a 40 F line is insulated with half inch insulation which has a conductivity of 0.28 and the air temperature is 80, the surface temperature of the insulation will be approximately 71.5 F.

"From examination of the psychrometric chart on which these values have been plotted, it is apparent that the line in question will remain dry in the original air, but will sweat badly in the air to which the addition of water vapor was made."

Unexpected Sources of Water Vapor Migration

Water vapor, according to Crawford, can come from many sources that do not show in the building plans, or become apparent in a casual examination of the job. In most buildings, he said, the greatest percentage of excess airborne moisture in the building came from the ground. He pointed out several building research studies, many of which were conducted by universities which have shown this to be the case. In most cases, it developed that this water comes through the concrete floor and walls of a basement, or from uncovered ground in a crawl space.

Crawford continued, "Large amounts of water vapor can also come from poorly designed or installed air conditioning equipment. Such items as condensate drip pans that do not drain, cooling towers that are improperly located, or evaporative condensers which are not adequately exhausted, can cause considerable grief."

Crawford next discussed the second major reason for the unexpected failure of insulation to prevent sweating, and again resorted to a psychrometric chart to make his point.

"A psychrometric chart," he said "illustrates the effect upon the insulation surface temperature resulting from a lowering of the air temperature." He then plotted the conditions which exist when the absolute of humidity of the air remains constant but the temperature is lowered. "If the air contains 106 grains of water per pound of dry air (as in the original example), the dew point will be the same as on the first chart, or 69 F.

"If the air temperature is 80 F, as it was in the first example, it is known that half-inch insulation with a conductivity of 0.28 on a 40 F line will have a surface temperature of 71.5 F. This air will have a relative humidity (RH) of 70 percent. If the temperature of this air drops to 72 F, then the insulation surface temperature will fall to approximately 65.5 F.

"From the chart then, it is evident that the insulation will remain dry while the air temperature is 80. F because the surface temperature will be above the dew point. But when the air temperature drops to 72 F, the insulation will be wet because its surface is now cooler than the dew point.

Unchanging RH The Villain

"At this lower temperature, the RH will be 90 percent. The change in RH is not the controlling factor as far as sweating is concerned. The sweating is controlled by the change in air temperature and its effect upon the insulation surface temperature."

The rise and fall of temperature due to everyday weather changes is usually accompanied by a change in dew point, Crawford explained, so that the conditions he had previously discussed seldom exist in the normal atmosphere. The trouble, he explained, originates with such situations where air in a building is cooled in such a way that the dew point does not change. Such conditions, he said, can be caused by cold surfaces in a confined pipe chase or suspended ceiling area, or the cold lines themselves can cause the cooling, if many of them are located in a small area with little or no influx of heat.

Installation Precautions

If air conditioning is to be installed in a building where vapor barriers were not used, he said it would be best to examine the basement area or crawl spaces for signs of excessive moisture. When doing this, he cautioned, it would be wise to remember that when the building becomes air conditioned, there will probably be a greater influx of water because of the higher vapor pressure difference. He also recommended that extra precautions should be taken in the choice of equipment, insulation and their installation, if signs of dampness are present.

"Be careful," he cautioned "of locations where large quantities of moisture are introduced by production operations and processes. All low temperature insulation surfaces must be kept warm, if there is to be no sweating. Do everything possible to keep the surface of the insulation from becoming chilled. This can be accomplished by keeping the cold lines spread out."

Crawford also warned that when insulating a system, all of the cold surfaces that are not over drip pans be insulated. In conclusion, he said that when designing or sizing air conditioning equipment, the engineer should bear in mind that the same troubles which cause sweating on cold lines and equipment also add an additional load on the refrigeration equipment, for if a good job of air conditioning is to be done, all of the excess moisture introduced into the building will migrate to and have to be removed from the refrigerated coils.

—FRED HERR

NAPRE QUESTION BOX

HAVE A QUESTION? Address it to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif. Answers appear monthly in this department on problems forwarded by NAPRE members. Comments from all readers welcomed.

H. P. Hayes

New Scientific Terms Trip Practical Engineer

QUESTION: New terminology, possibly product developments that I have spotted in news accounts or features in Industrial Refrigeration and other trade publications, uses words with which I am unfamiliar; for example, the phrase "filled epoxy resins". That name has come up in connection with the electrical field and in connection with thermal and electrical insulations, as well as compounds, including metal adhesives. What is it and why is it important to our field?

Another name is "polymer". This apparently has something to do with the field of plastics. Can you tell what connection that has with the plastics found in thermal insulation and with the plastic used for pipe and tubing?—K.C.F., D.C.

ANSWER: This engineer has the sympathy, not only of his practical associates, but that of many educators and professional engineers in the industry. The chemistry field has come up with so many new developments to benefit modern industry that the users are hard put to keep abreast. What is perhaps needed is a practical series on new scientific terms that will be more or less common to our industry within the next decade.

Epoxy resins are a potting and encapsulating insulation developed by such firms as Bakelite for electronic and electric assemblies such as coils, armatures and other components.

New Electrical Insulation

Most recently, our reader has seen the term *filled epoxy resins* used in connection with electric motors and equipment manufactured by Allis Chalmers Mfg. Co. Epoxy resins used by this firm are solventless thermoplastics, molded to completely enclose smaller stator windings. The material is one of the best adhesives developed, as well as an insulation. Therefore while the plastic sets it forms a bond with stator laminations, excluding moisture penetration as well as other contaminants. According to an A-C correspondent, their material is a Dow development.

Needed: Plastics Dictionary

Here is what F. S. Swackhamer and R. A. Corderre of Shell Chemical Corp. had to say about epoxy resins in an excerpt from the MODERN PLASTICS ENCYCLOPEDIA passed along to your Question Box Committee by Richard J. Woodward of E. I. duPont de Nemours & Co.

"Epoxy resins are well known in industry for their excellent properties in structural applications and in protective coatings. When cured into thermoset polymers, these resins show excellent strength, electrical properties, adhesion, and chemical resistance. In coatings they combine outstanding adhesion, flexibility, and chemical resistance. In adhesives they set at low temperatures and bond a large number of materials successfully. As casting or laminating resins they combine high strength with low shrinkage during cure.

Commercial Developments Marketed Over 10 Years

"Commercial epoxy resins are polymers of varying molecular weight. The resins have been marketed since 1947.

"Development of epoxy resins in commercial applications was a result of independent research by Ciba Co. in Switzerland and Devoe and Reynolds in the United States. Ciba's original interest was mainly concerned with adhesive formulations, while Devoe and Reynolds worked primarily with surface coating applications. In the past five years extensive applications research in laboratories of Shell Chemical Co., Ciba, Bakelite Div. (UCC), and Devoe and Reynolds has sparked the exploitation of these resins in a number of industries."

Related Questions

We'll bet that **K. C. F.**, didn't associate *polymers* with *filled epoxy resins* when he asked this question. The Question Box committee didn't either until the gentlemen from Allis-Chalmers and duPont directed our attention to PLASTICS ENCYCLOPEDIA.

Now, regarding polymer, here is what a chemical dictionary has to say:

Polymer—any of two or more polymeric compounds (polymeric, consisting of the same elements in the same proportions by weight, but differing in molecular weight; as cyanic acid (CNOH) and cyanuric acid ($C_2N_2O_2H_2$) are polymeric with each other).

"*Polymerize*—to change into another compound having the same elements in the same proportions, but a higher molecular weight and different physical properties."

More Definitions

A little difficult? Well, try this, from our friend R. J. Woodward: "A *polymer* is defined as 'a large molecule formed by the union of small similar molecules'. These small similar molecules are known as *monomers*. *Polymerization* is the process by which polymers are formed. Hence polyethylene, the familiar plastic, is the *polymer* of ethylene *polymerized* under pressure and in the presence of a catalyst to yield the giant molecules which form the plastic."

Thermal Applications

All right, that has probably helped clear the air. Now let's switch from the electrical field to the thermal insulation field and see what George B. Peterson, Jr., at Dow Chemical Co. has to say on the subject.

"The term *polymer* refers to an assembly of chemical parts, so to speak. The individual parts are usually expressed as the simplest unit of the chemical compounds and are called *monomers*. Under controlled conditions, monomers can be made to link with themselves, and form heavier

masses which are often plastic materials. Chemists use the terms *monomer* and *polymer* with facility because these terms carry many connotations which mean different things according to their vein of discussion. They often refer to *thermoplastics* as polymers. For example, *styrene monomer* may be made to polymers of styrene which are known in the plastics world as *polystyrene*.

Thermoplastics can be melted, solidified and remelted indefinitely. In the molten state, polystyrene can be foamed with air to form millions of non-interconnected air cells. These are entrapped when the material cools and solidifies.

Insulation Materials

"It is well known that air in small cells is the most effective insulator; thus, the millions of cells in foamed polystyrene make it one of the most efficient low temperature insulations known. Its use for high temperature insulation is limited because of the melting point of polystyrene. **Styrofoam** is The Dow Chemical Co.'s trademark for their expanded polystyrene, which was the pioneer plastic foam insulation for low temperature warehouses, coolers and freezers.

Foamed In Place

"Recently, polystyrene in the form of beads has been developed, the beads having the unusual property of foam, the shape of their container or mold. Dow calls its foaming beads **Pelaspan 8**. One of its major uses is in refrigerators, where the ability to conform to shape makes the material ideal for insulating irregularly shaped refrigerator panels.

"To reiterate, Styrofoam and Pelaspan 8 basically are polystyrene, and polystyrene is sometimes termed styrene polymer.

Piping Another Polymer

"Plastics used for pipe and tubing are simply polymers of other basic molecules, with properties making them especially suitable for this one.

"Also, two different monomers can be combined to form **copolymers**, three monomers combined to form a **terpolymer**. It follows, of course, that these materials have two and three basic molecules, respectively, and exhibit different properties."

Well, there you have your definitions and what they mean to two segments of our industry. Perhaps this will encourage some plastics or chemical engineer to come to our aid with a practical course in refrigeration chemistry so we can recognize the terms which are applicable to our field.—**J. M. McGrath.**

Refrigeration Nomenclature

QUESTION: Wolfberg's articles in the November and December '57 issues of IR, like those of another year or so ago, are very good with respect to helping a practical engineer understand what the professional engineer intended. However, there is one thing he overlooked. How many operators without pneumatic control experience really know what he meant by an E.P. valve?—B.C.M., Dayton.

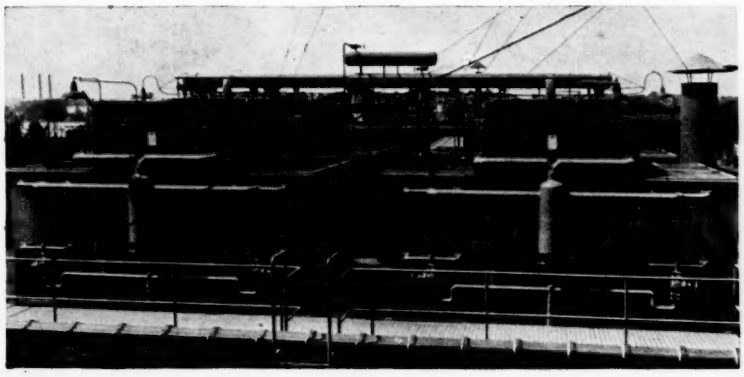
ANSWER: BCM is not alone in commenting on lack of a definition. Most engineers, operators, servicemen and technicians with little commercial pneumatic control experience do not recognize that the expression E. P. valve is an abbreviation of the term "electro-pneumatic valve", which normally defines a three-way, direct acting solenoid valve used for switching pneumatic control circuits. In fact, the expression E. P. valve probably is not extensively used for describing control applications outside of the commercial field, particularly in conjunction with the relatively expensive pneumatic process and industrial controls such as are commonly used in refinery work.

However, the 1957 November and December articles dealt with the application of commercial controls, and the length and scope of these articles did not permit explanations of the basic definitions, designs and applications of control circuits. I believe what is needed are more articles defining the intent and function of basic controls and control systems. With this knowledge, articles such as appeared in those issues of IR can probably be better understood and used to advantage by operators and engineers with little previous control experience.

Emphasizes Control Training For Practical Engineers

It is important to understand that the industrial refrigeration picture is radically changing, and new products and automation are major developments. The operator of tomorrow will have to possess a knowledge of controls and their applications to refrigeration systems to justify his position.

—**H. A. Wolfberg**



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Write for Bulletin 131

NIAGARA BLOWER COMPANY

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Niagara District Engineers in Principal Cities of U. S. and Canada

Removing Oil From Aero-Sols

QUESTION: Aero-sol propellants received via railroad car at our charging plant are discharged to storage by pressurizing the tank car (tankers have outlets similar to refrigerant receivers). We employ a Brunner compressor, 4-cyl. Model NR-10 (V type, 3-5/8 x 2-1/2-in) W56-1 operating at approximately 420 rpm. This unit taking suction from our storage tank, discharges through an oil separator and into the tank car at from 50 to 70 spig.

Our problem is this: The supplier contends that we are contaminating the tank car with refrigerant oil and he is back-charging us for cleaning. Our oil separator has no name plate data on it so we do not know the particulars other than it has a 1-5/8-in. OD inlet and outlet, etc. However, we believe that the separator is probably too small or its structure is ineffective. Where can we find literature that would describe the most effective way of removing oil from the compressed aero-sols? They are mostly Refrigerant-12, and combinations of holacarbon gases involving Refrigerant-12. Is there any literature that specifies size and internal arrangements for oil separator vessels?—C.W., Chgo., Ill.

LMTD By Nomograph

QUESTION: Would the practical engineer have an occasion to be involved with a formula such as that determining the Logarithmic Mean Temperature Difference? Or, do such pencil and paper manipulations come up only in the realm of the designing engineer? Would a Nomograph cut corners for both the professional and the practical engineer involved in such computations?—J.R.K.

Holding Humidity Down With Indirect Refrigeration

QUESTION: One carload of ice which G. S. A. in his question on "Material Heats" in the September issue, wasted, could have been used very readily by this writer not too long ago. Contrary to usual practice, we were required to store a product at less than 50 rh, at a temperature of 36 to 38 F. Like G. S. A., I had some obsolete buildings only I was more fortunate in the fact that they were cooler storage rooms. I also had some old brine pipe coils but no more refrigerating plant. I didn't overcome my humidity problem, the merchandise in cans rusted, and we took a loss.

I have often thought of what I would do again in such an event, using a portable pump and a water ice refrigerant. Would someone care to check me by outlining steps to be taken, to accomplish the rh and temperature requirements if the room size is given, number of lineal feet and size of pipe, and the horsepower or gpm of the pump? The product was precooled when it was delivered and we were to hold it at these conditions in the field.
—J. A. H., Los Angeles.

Insulation K Factor

Question: What is the K factor of semi-rigid pre-formed one-inch thick fibrous glass insulation encased in a polyester film?—S.R., Minn.

NATIONAL QUALITY

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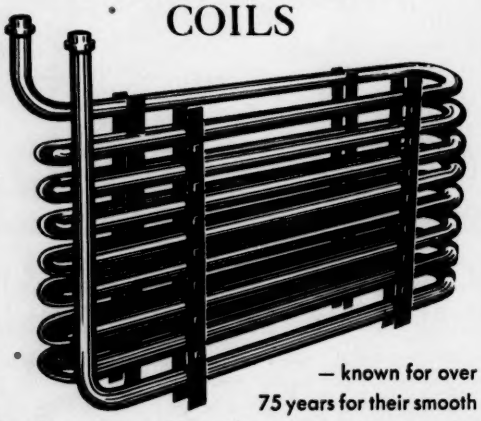

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the QUESTION BOX

Designating Refrigerants By Chemical Compound Expressions

QUESTION: Our refrigerating system uses Refrigerant 113. In the compressor manual it is described as trichlorotrifluorethane (CCl_2F-$CClF_2$). Guy King's Table 9 in his paper "New Refrigerants", 1957 NAPRE Operating Data Book, shows the same gas to have a chemical formula of $C_2Cl_3F_3$. I presume either way to write it is correct but I would like to know why one author expresses the formula one way, and another author a longer more complicated expression.—R.L.F., Chicago.

Modulating BP Valves

QUESTION: "Proper Refrigeration Increases Meat Profits" by D. D. Wile, January '58, page 31, IR, quotes the results of tests in which the modulating type of back pressure valve was used. This valve increased the back pressure at which the evaporator worked according to air temperature in the room. We in Australia are not acquainted with this sort of valve but feel it has a distinct usefulness. Who supplies this equipment? And upon what drive? Automatic start is almost impossible with flat belt."

V-Belt Article Prompts Drive Conversion Question

QUESTION: "Long-Lived V-Belts" in September 1958 IR prompted me to write about a silent chain drive which broke. A new chain was not available, The mechanic made a belt drive out of it wrapping lengths of silent chain around the sprokets and making those lengths endless. On the backs of the chains then, which were fairly smooth, he used a belt drive. The diameters of the sprockets were about 10 and 16 inches respectively, and with the chain on, about one inch greater. The width of the chain (also the belt) was 10 inches. The speed of the motor was 900 rpm. The motor horsepower was 75.

Flat Belt Precludes Auto-Start

When consulted, I figured that the belt speed was about 2590 fpm. This speed should allow a 2-ply belt to transmit 62.75 hp—which is fairly close to the above 75 hp. However, I further suggested a special high grade belt should have been used. Now, I'll ask the Question Box what was asked of me, "Why not convert to V-Belt drive? Automatic start is almost impossible with flat belt.

—W. F. S., Newark.

Wiring Hookups For New Motor Voltages

QUESTION: We have a 175 hp synchronous motor direct drive rewound from two-phase to 3-phase, only name plate reading is 175 hp, 225 rpm, 2300 volts and "rewound to operate on 4160 volt, 3-phase. The motor has 6 name plate for 3-phase but six leads. What method can I take for checking these leads for 4160 volt and type of connection?

Some years ago I worked in a steel mill electric shop where we changed 220/440-volt motors for 208. There we shoved six leads back in the stator and used the 220 leads for 208. What is the difference of power consumption in that case and what would be the loss in torque?—R. P. E., San Antonio.

"We're not agin' automation"

. . . but it has limitations. That's why these men are pouring Palmyron for Hubbell castings at Hubbell's Wisconsin foundry. This is one job that machines will probably never perform here. Why? Because it takes long experience and real craftsmanship to meet Hubbell standards for this critical operation. This is typical of the careful attention that goes into every component, because at Hubbell, quality has been and always will be more important than volume. ***"From castings to finished controls... every inch HUBBELL"*** is more than a slogan—it's a fact! Find out for yourself the next time you order refrigeration controls.

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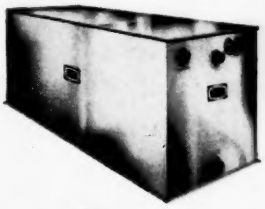

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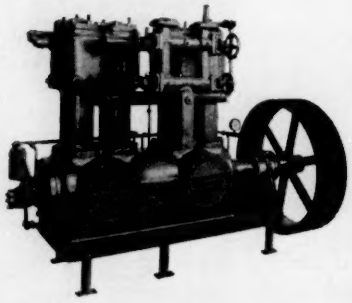

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Personnel News Around The Industry

O. P. Heller

R. L. Ross

Heller Retires from CP Mfg.

▶▶ SECRETARY and Director of Sales-Service of the Creamery Package Mfg. Company, Otto P. Heller has retired from active status with the Chicago firm. Heller had completed 50 years of continuous service according to the announcement from E. B. Lehrack, president. He is also a life time member of ASRE.

Heller has been identified with the refrigeration industry since 1903 and was manager of the Refrigeration Department for many years, during which time he participated in the evolution of refrigerating machines from several types of the early horizontal compressors to present multi-cylinder line.

Two Staff Additions At Diamond Alkali

▶▶ PURCHASING DEPARTMENT of Diamond Alkali Company announced two staff additions through Chester D. Jones, general purchasing agent. They are Henry T. Myers, a transferree from the company's Deer Park, Texas plant to be responsible for construction contracts; and Joseph T. Lint who will be responsible for equipment purchased, including refrigeration and air conditioning machinery and supplies.

J. P. Johnson

Jerry Johnson To Dallas Post

▶▶ EARLY IN NOVEMBER it was learned that Jerry P. Johnson former Vice-president, NARW, had been elected executive vice-president, Great Southwest Distribution Center, Dallas. Johnson who had been residing in Santa Barbara, California, will relocate. He was former president and general manager of Terminal Refrigerating and Warehousing Corp. in the District of Columbia, and more recently with Merchants Refrig. Co., Western Div.

Ross Tours Europe For Phillips & Co.

▶▶ RETURNING this month from Europe is Robert L. Ross, the sales representative of H. A. Phillips & Company of Chicago. Ross toured Norway, France, Italy, Switzerland and the United Kingdom calling on Phillips representatives and original equipment manufacturing accounts in those countries. The firm manufactures and distributes a line of floats, liquid traps, 3-way valves, check-valves and liquid return systems for ammonia.

Sporlan Reorganizes Field Sales Offices

▶▶ GENERAL SALES MANAGER W. H. Krack, Sporlan Valve Co., St. Louis, announced in October a new organizational structure for its field sales offices. The firm's 17 nationwide sales offices have been regrouped into nine geographical sales districts. Veteran Sporlan sales engineers are being promoted to district managers to head each of the new areas. Field offices will be continued but their supervision is the responsibility of the district manager.

W. A. Reichenbach

Reichenbach Promoted

District Manager for the area that now encompasses the New York and New England territories is W. A. Reichenbach. He will supervise these territories from the branch office at Mt. Vernon, New York. Reichenbach has previously covered New York City and portions of the States of New York and New Jersey, as a sales engineer.

Perkins Heads ACCO

▶▶ ELECTED CHAIRMAN of the Board of Directors, American Cyanamid Company was Thomas L. Perkins, a director of the company since 1951.

COMING CONVENTIONS

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
December 1-3, 1958
Roosevelt Hotel, New Orleans.

NATIONAL WARM AIR HEATING AND AIR COND. ASSN.
December 1-4, 1958
Cleveland, Ohio

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING
December 1-5, 1958
New York Coliseum, New York, N.Y.

DAIRY & ICE CREAM INDUSTRY EXPOSITION
December 7-13, 1958
Navy Pier, Chicago, Ill.

INTERNATIONAL ASSOCIATION OF ICE CREAM MANUFACTURERS
NATIONAL ASSOCIATION OF RETAIL ICE CREAM MANUFACTURERS
Conrad Hilton Hotel, Chicago, Ill.

DAIRY INDUSTRIES SUPPLY ASSOCIATION
Congress Hotel, Chicago, Ill.

MILK INDUSTRY FOUNDATION
Hotel Sherman, Chicago, Ill.

INTERNATIONAL HEATING AND AIR CONDITIONING EXPOSITION
January 26-29, 1959
Convention Hall, Philadelphia

10TH PLANT MAINTENANCE & ENGINEERING CONFERENCE
January 26-29, 1959
Public Auditorium, Cleveland, Ohio

AMERICAN SOCIETY OF HEATING AND AIR-COND. ENGRS.
January 26-30, 1959
Bellevue-Stratford, Philadelphia, Pa.

PRIVATE TRUCK COUNCIL OF AMERICA, INC.
January 29-30, 1959
Sherman Hotel, Chicago, Ill.

INSTITUTE OF AMERICAN POULTRY INDUSTRIES
February 13 to 15, 1959
Municipal Auditorium, Kansas City, Mo.

NATIONAL ASSN. OF FROZEN FOOD PACKERS
March 1-5, 1959
Conrad Hilton Hotel, Chicago, Ill.

THE REFRIGERATION RESEARCH FOUNDATION
April 2-5, 1959
Statler and Mayflower Hotels, Washington, D.C.

NATIONAL ASSOCIATION OF REFRIGERATED WAREHOUSES
April 5-9, 1959
Statler and Mayflower Hotels
Washington, D.C.

EDISON ELECTRIC INSTITUTE
April 5-9, 1959
New Orleans, La.

NATIONAL INDEPENDENT MEAT PACKERS ASSOCIATION
April 16-19, 1959
Palmer House, Chicago

AIR-CONDITIONING AND REFRIGERATION INSTITUTE
May 3-6, 1959
The Homestead, Hot Springs, Virginia

NATIONAL FIRE PROTECTION ASSOCIATION
May 25-29, 1959
Atlantic City, New Jersey

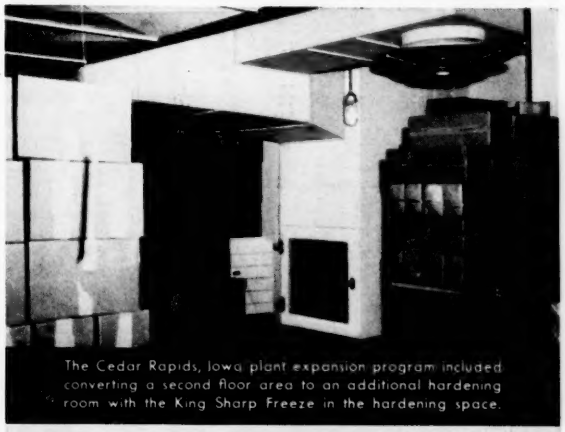
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, INC.
June 7-11, 1959
Vancouver, B. C.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
June 22-24, 1959
Lake Placid Club, New York

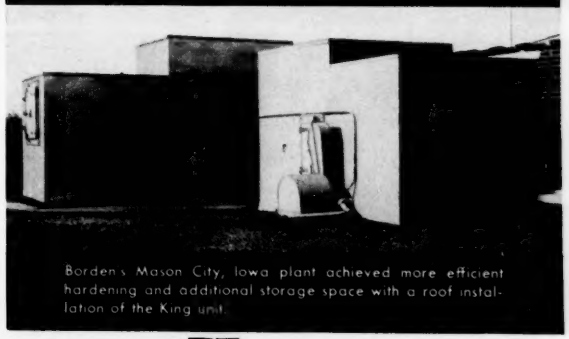
Borden PLANTS PROVE FLEXIBILITY OF **KING SHARP FREEZE SYSTEMS**

Many Borden Company plants throughout the nation have found that King Sharp Freeze Systems are adaptable to the particular needs of individual plants.

King Sharp Freeze units may be installed in the hardening space, just outside of it, above or below it. Below are two different applications which satisfied specific plant requirements.



The Cedar Rapids, Iowa plant expansion program included converting a second floor area to an additional hardening room with the King Sharp Freeze in the hardening space.



Borden's Mason City, Iowa plant achieved more efficient hardening and additional storage space with a roof installation of the King unit.

Write for detailed technical bulletin.

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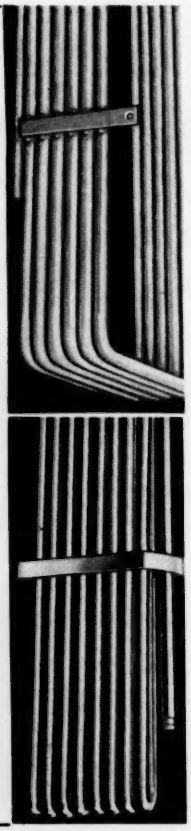

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News Around The Industry

New Coil Company By Three Chicagoans

▶▶ ANDERSON-SNOW Corp., a new manufacturer in the coil line was announced in October. Russell E. Anderson, Norman Snow and Ray Rutkowski are the three principals. The firm will manufacture a standard line as well as custom built coils. The product will feature heating and cooling coils, air handling equipment for use in heating, ventilating, refrigerating and air conditioning systems. All three founders have had extensive experiences in the manufacturing of such components and are well known in the field. The new plant is located in Chicago.

Railroaders Honor Dodge At Retirement Dinner

▶▶ RAILROAD and transportation executives tendered a testimonial dinner on October 21 at the Pfister Hotel, Milwaukee, to honor Thomas A. Dodge, retiring executive assistant to the vice-president of the Union Refrigerated Transit Co. Dodge, 63, completed 46 years in the transportation field when he retired November 1. He started in 1912 as a freight handler at Rochelle, Ill., for the Milwaukee road. In 1926 he joined Union Refrigerator, a division of General American Transportation Corp., as general agent. He later became western traffic manager and in 1925 was promoted to his present post. He plans to move permanently to a summer home in Birchwood, Wisconsin.

Stearns Re-elected By Wisc. Warehousemen

▶▶ WISCONSIN'S Warehousemen's Association, meeting late in September at Fond du Lac re-elected David B. Stearns, Milwaukee, as president. Maurice E. West, Fond du Lac was re-elected executive vice-president of the cold storage division.

Arthur J. Hess Nominated For ASHAE President

▶▶ ARTHUR J. HESS, President of Hess-Greiner & Pollard, Los Angeles, Calif. has been nominated for president of the American Society of Heating and Air Conditioning Engineers, and the election will take place during the 65th annual meeting of the Society, January 26-29, 1959 in Philadelphia.

Mr. Hess has served as first and second Vice Presidents of the Society and Chairman of the Regions Central Committee. He has served as a past president of the American Society of Refrigerating Engineers.

Personnel Changes For Northern Reefer Line

▶▶ EFFECTIVE Nov. 1, Homer L. Campbell became president of Merchants Despatch Transportation Corp. and Northern Refrigerator Line, Inc., with headquarters in Chicago. Campbell succeeded Kenton C. Underwood, retired from active service in accordance with pension rules. The announcement was made by A. E. Baylis, Chairman, Executive Committee of the two lines.

Appointed Manager of Operations of these companies is Joseph C. Patrick. Frank C. Underwood was appointed assistant to the president. Position of assistant to the vice-president and general manager was abolished.

Kuehn Honored By Milw. Commerce Ass'n

▶▶ MILWAUKEE Association of Commerce recently elected Philip G. Kuehn as a director. Kuehn is president of Wisconsin Cold Storage Company and national president of NARW. Association president Lester S. Olsen appointed Kuehn as chairman of the Association's National Affairs Committee.

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COLD STORAGE—FOOD PROCESSING—INDUSTRIAL

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COMPLETE ENGINEERING DESIGNS FOR TEMPERATURE AND HUMIDITY CONTROL.

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Deaths of Industry Persons

Hoskins Dies in Houston

NEWSPAPERS in Houston in Mid-September carried news accounts of the death of L. B. Hoskins, refrigeration engineer. He was 59. Hoskins had been well known in the industry having served it as a constructor of ice plants and later as a refrigeration and air conditioning engineer for many industrial applications, since 1918. He was a member of the National Association of Practical Refrigerating Engineers as early as 1918, being affiliated with the earlier Mississippi and Texas Chapters. Most recently he signed as a charter member of the new Houston Chapter.

In association with Charles A. Zilker of San Antonio, now deceased, he built many ice plants in various parts of the United States and Mexico. He had been employed by York Corporation as construction superintendent on various projects over a span of 14 years, and had served in 1934 through 1940 on various PWA construction projects in the State of Mississippi. A native of that state, he was returned to Jackson for burial. Survivors include two daughters, a brother and three sisters.

C. P. Wood Dies

C. P. WOOD, former head of the C. P. Wood & Company, Cincinnati, Ohio and a pioneer in the refrigeration equipment business died of a heart attack on October 8. Mr. Wood started in the equipment business with the old Triumph Ice Machine Co. in 1898 as a blueprint boy, and then advanced to Chief Draftsman, Salesman and finally Sales Manager when he severed his connections in 1922 to form his own company. The company was first associated with the Artic Ice Machine Co., and shortly thereafter in 1925 affiliated with the Vilter Manufacturing Co. which association has continued to the present time.

C. P. Wood, Jr. and David E. Wood are continuing the business under the company name.

PHILLIP E. BROU, 34, resident air conditioning specialist of A. M. Lockett, Jackson, Miss. was killed with two other men, September 27, when a Navy helicopter which he was piloting crashed and exploded in a swamp along the Mississippi River near New Orleans. Mr. Brou who was a Lieutenant Commander in the Naval Reserve and in charge of the helicopter squadron was on a training mission when the crash occurred.

Northern Foreman Dies

RETIRED GENERAL FOREMAN of Northern Refrigerated Line, Cudahy Company, Leonard Birch, died on October 20 at Mercy hospital. Born in Germany, Birch came to Milwaukee in 1872, working for Union Refrigerated Transit Lines until he joined the Northern firm in 1921. He is survived by four daughters.

HARRODSBURG Ice & Produce Company lost a loyal 30-year employee in the death of *E. P. Terhune*, 77. He died September 10, at Veterans Hospital, Louisville. He is survived by his widow and two daughters.

SERVICES were held in mid-September for *Nathan Levi Axton*, retired auditor for a number of Tulsa Ice Companies. He had been ill since April and died in a Tulsa hospital.

Before moving to Tulsa in 1931, he was manager of the Eldorado, Kansas Ice Company. At Tulsa he was manager of the Pure Ice Co. until World War II when the ice companies in Tulsa formed a combine and divided the town into districts. He was auditor of that organization until he retired. He is survived by his widow, 3 sons, 2 brothers and 5 grandchildren. He was a member of NAPRE and Civitan club.

Classified Advertising

All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words. $2.00 per line for bold face headings: $15.00 per inch for line listings.

Position and Help Wanted

WANTED—Chief engineer, cold storage operation; multi plant company, eastern location. Full charge refrigeration and maintenance. Give experience, age, salary desired first letter. Write Box OT-6, c/o Industrial Refrigeration.

WANTED—Chief engineer and general superintendent for large cold storage fish freezing plant in foreign country. Must speak Spanish fluently and be able to handle help and business relations. State salary expected. Address BOX DC-9, c/o Industrial Refrigeration.

USED EQUIPMENT—wanted & for sale

FOR SALE—One 4x4 twin cylinder York compressor, with 7½ h.p. motor, V belted, on one base. One 20"x10 ft. receiver. Write E. Niebling, 1546 St. Clair Ave., Mt. Healthy, Cincinnati 31, Ohio.

FOR SALE—Complete WORTHINGTON refrigeration system, 1700 ton, fine condition, priced right, Midwest. Born Company, 80 East Jackson Boulevard, Chicago 4, Illinois. WAbash 2-3299.

WANTED—Used ice plants and refrigeration equipment. Address Box OT-4, c/o Industrial Refrigeration.

WANTED—Late model ammonia compressors and condensers, preferably standard make such as Frick, York, Vilter; give complete details including motor specifications, model, serial number, age, general condition and your asking price in first letter. Dealers invited but we must have immediate action on late model equipment only. Write Box DC-5, c/o Industrial Refrigeration.

FOR SALE — Refrigeration equipment; ice equipment; new, used. Advise us your needs. Use "QUICKSEAL" — stops brine tank leaks; easy, efficient, economical. Born Company, 80 East Jackson Boulevard, Chicago 4, Illinois. WAbash 2-3299

FOR SALE — SEE IN OPERATION
Complete cold storage engine room ammonia equipment including Frick 11½ x 8 — D.C. to 60 h.p., 400 r.p.m. Worthington 7 x 7 D.C. to 50 h.p., 400 r.p.m. Worthington horizontal high-low duplex d.c. to 100 h.p., 225 r.p.m. Vilter 10½ x 10½ belt drive by 100 h.p., 1750 r.p.m. Vilter 9½ x 7 belt drive by 30 h.p., 1200 r.p.m. All force feed lubricated; motors 220 volt 3 phase. MG sets, starters, panels spare parts included.
CENTRAL WAREHOUSE COMPANY
739 Pillsbury Ave. St. Paul, Minn.
Phone: MIdway 6-2831

FOR SALE—3 only Niagara 60-ton ea. evaporative condensers, ASME code stamped receiver, etc., still hooked up at closed food plant in Western New York state; inquiries invited; immediate delivery at bargain prices. Address Box DC-7, c/o Industrial Refrigeration.

FOR SALE
FORT PITT BREWERY, PITTSBURGH
Complete plant including Vilter 10½x10½, 2 cylinder ammonia compressor with Westinghouse 125 h.p., 60/220, 3 phase, 275 r.p.m. motor, panelboard controls, all condensers, receivers, ammonia pipe, room blowers, valves; everything as last used up until a few months ago. Write for further details to Mr. Frank Kogler, Master Brewery, Fort Pitt Brewery, Sharpsburgh, Pa.

FOR SALE
350 h.p. Carrier water chilling unit.
(2) 100 h.p. & (1) 75 h.p. brine chilling units.
(1) 9 cylinder & (2) 6 cylinder type AHP Frick "Eclipse" compressors.
(2) type 15Q6 Carrier cold air diffusers.
9x9 York "Duples" 200 h.p. compressors.
7½x7½ York & 7x7 Frick compressors.
MG sets, air compressors, water pumps, etc.
JOHN F. CARSON
A & Venango Sts. Philadelphia 34, Pa.
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Ice Plants For Sale

FOR SALE—12 ton ice plant; good location. Will sell lot, building and plant as located or separately. Reasonable down payment and terms on balance if sold as unit. First National Bank, London, Kentucky.

USE CLASSIFIED ADS REGULARLY

BOOK REVIEWS:

Refrigeration and Air Conditioning

REFRIGERATION AND AIR CONDITIONING—$8.00
Author—W. F. Stoecker
Publisher—McGraw-Hill Book Co.

▶▶▶ BEST MEANS to the ultimate end in refrigeration—is a study of the science based on three prerequisites. So says W. F. Stoecker, Assistant Professor Mechanical Engineering, University of Illinois, in the Preface to his book REFRIGERATION AND AIR CONDITIONING. The prerequisites are thermodynamics, heat transfer and fluid mechanics. As Stoecker states, elements of these three fields are abbreviated and utilized in his book to explain refrigeration and air conditioning functions.

Industrial Applications

Properly so, the Author introduces his student to this refrigeration text by describing industrial applications in which refrigeration is utilized. First application, of course, is food preparation, distribution and preservation; still the biggest application, tonnage and dollarwise. In the same introductory chapter he summarizes applications in the chemical and process fields as well as devoting four pages to special uses. Industrial air conditioning is given equal treatment with the comfort application.

Study Sub-divisions

Following this introductory chapter, Stoecker describes the methods of refrigeration. These first two chapters he considers one of the major subdivisions of his text. Next subdivisions deal with the vapor compression cycle, special types of refrigeration systems, heat transfer, and design.

Advanced Practical Text

For text book purposes he recommends that the material be covered in a single semester using the first 10 and the 16th through the 21st chapters. For adult under-graduate work by such organizations as NAPRE, this reviewer would concur. However, the required prerequisite would be study of the NAPRE offical text and some guidance on the part of a professional instructor when Stoecker's text is undertaken for advanced work.

As an example of the up-to-dateness of this text, the chapter on heat pump includes industrial applications such as concentration of citrus fruit juices and milk products. For the practical engineer the chapter on absorption refrigeration also includes a lithium bromide–water vapor system. A chapter is devoted to steam jet refrigeration which has also seen a revival of use in recent years for industrial processes and applications.

W. F. Stoecker

NAPRE Director Comments

Adding to the comments by IR's reviewer, the NAPRE Educational Director had this to offer, "Chapter on complete systems would be readily understandable and, as Stoecker hoped for, beneficial to NAPRE members. His handling of reciprocating compressor performance in other sections is helpful to even the more experienced practical engineer who has had to wrestle with more technical texts written for college graduates.

"Although a number of new books have appeared in the past ten years, it is believed that Stoecker's book contains some original thoughts on both compressor and system performance improvements. Maybe these could be called trends toward multi-stage, recirculating, and while they are more popular today they wouldn't exactly be new. However, few texts deal with them in any detail.

Previous Papers & Talks Extended In Chapters

"Readers of IR will certainly be interested to learn that the chapter on multi-pressure systems is primarily an extension of the two articles which appeared early this year in IR[1]. It should be pointed out that Stoecker gave that paper at the NAPRE 48th Annual Meeting held in Chicago, in 1957."

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[1]Multi-stage Refrigeration Systems, February 1958, page 25, and March 1958, page 26.

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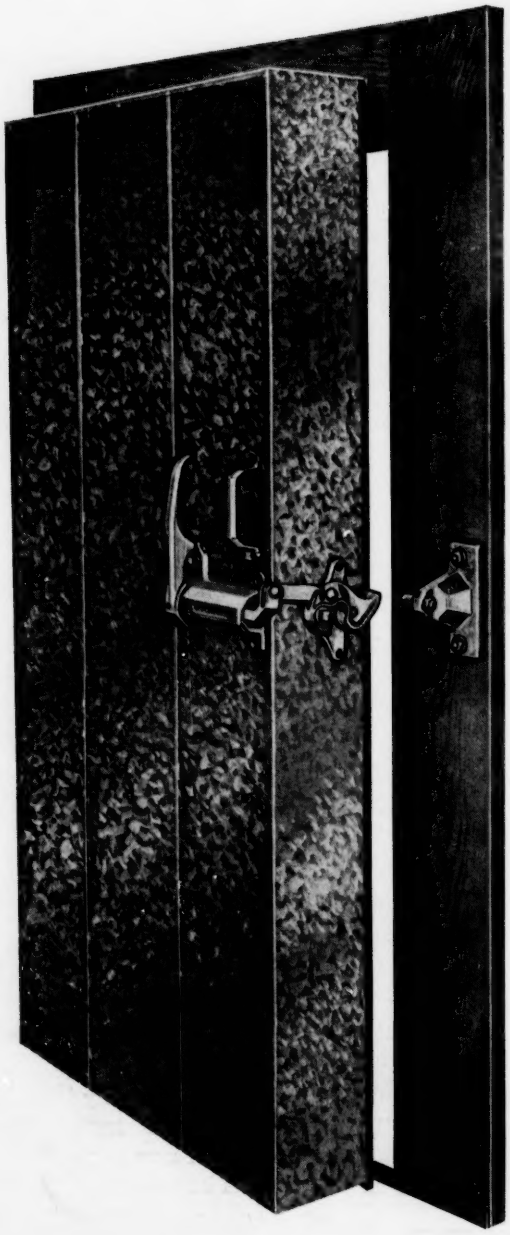

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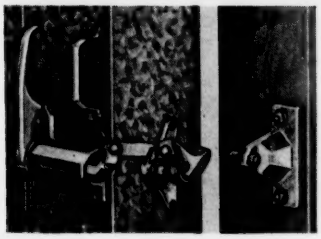

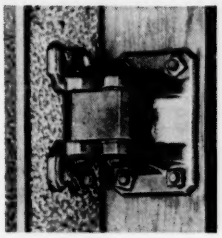

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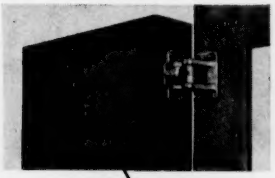
- Prevents door from freezing shut, eliminates damage from forcing open frozen doors
- Assures tight seal at all times, prolongs gasket life.



ZEROSEAL GASKET

TRIPLE SILLSEAL GASKET

Exclusive JAMISON Gasketing

"Zeroseal"

- Wide, flat seal
- Extends around sides and top
- Extra resilient and pliable

"Sillseal"

- Triple Wiper Seal
- Flexible, abrasion and grease-resistant
- No capillarity

Full details on the Jamison Super Freezer Door are contained in Bulletin #5. Write for your copy to Jamison Cold Storage Door Co., Hagerstown, Md.

JAMISON

COLD STORAGE DOORS

Jamison Cold Storage Door Co., Hagerstown, Md.